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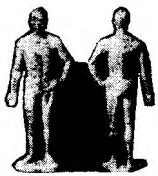

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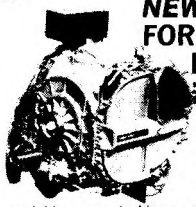

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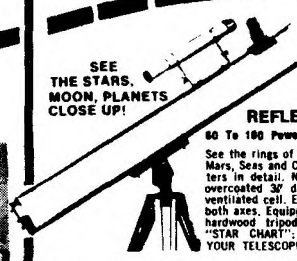

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this month

Much has been written lately on the apparent physiological miracles of acupuncture. Medical doctors—scornful at first—were so badgered by hopeful patients and driven by the rising storm of "wonder cure" reports, that even the stodgiest began looking at the procedure out of curiosity if nothing else. Until about a year ago, however, there had been virtually no scientific study of acupuncture that could be considered "empirical research" even remotely. Everything was hearsay: eyewitness reports by a handful of adventurous physicians traveling through China; the word of patients who had experienced real or imagined "cures" from Oriental needles. Now a number of studies are under way at last, and several knowledgeable medical authorities have looked into the matter with some degree of professional objectivity. Dr. Michael E. DeBakey, president of Baylor College of Medicine in Houston, Texas, and famous for his career in heart surgery, reported recently on half a dozen operations he observed in China, in which acupuncture was used as an anesthetic. Dr. DeBakey, while in no way deprecatory, professed skepticism as to its value to medicine. He observed that different acupuncture points were used for the same operation on different people. Also that in each case, morphine was injected prior to surgery and that novacaine was administered at the point of incision. The fact is that no one yet knows what acupuncture *can* do. But out of the laboratories, some sound information is beginning to come—most of it concerning what the needles *can't* do for you. Dr. Arthur Freese has rounded up all of the information he could find on this fascinating subject. It's on page 10.

—Richard F. Dempewolff

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The National Center for Atmospheric Research created this mathematical model of the atmosphere to help understand pressure patterns and clouds. For the story on how man is changing the weather, see page 18.

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SCIENCE DIGEST

December 1973

Vol. 74, No. 6

NEWSFLASHES

Bulletins at press time

AFTER THEIR RECORD-BREAKING SPACEFLIGHT of 59 days, Skylab II astronauts brought back 16,800 pictures of the earth, 18 miles of tape with observation data stored on it and 77,600 pictures of the sun's corona, enough raw research material for an army of solar physicists. Also, the excellent physical health of the astronauts and the ease with which Arabella and Anita the spiders adapted to weightlessness indicate to scientists that men are much more adaptable to space than scientists previously thought.

OVER THE NEXT TEN YEARS THE LAUNDRY BILL FOR CLEANING UP pollution will run about $274.2 billion, according to the Council on Environmental Quality (CEQ). According to Chemical and Engineering News, the major costs will be $105.6 billion for air pollution, $121.8 billion for water, and $41.8 billion for solid waste. Without any pollution abatement the CEQ estimates that damages from air pollution alone will reach $24.9 billion by the middle of 1977.

THE LAST NEW INTERPLANETARY ROCKET NASA HAS DEVELOPED, the Titan 3-Centaur, will be launched on a test flight next month. The Centaur is scheduled to be used in landing robot probes on Mars in 1975 and 1976, in studies of the sun next fall, and in fly-by missions past Jupiter and Saturn. The rocket is capable of carrying a 34,000-pound payload on its interplanetary explorations.

DOOMSDAY MAY BE LATER THAN YOU THINK, according to chemical engineer Thomas J. Boyle, who said a typographical error was responsible for the Club of Rome prediction of global collapse in the 21st century. Using the same computer programs that led the Club of Rome's MIT team to their predictions, Boyle found a faulty number sequence describing the rate of industrial pollution. Writing in Nature magazine, he predicted a stable world situation by the year 2100.

PEOPLE STILL TRUST SCIENCE according to a survey conducted for the National Science Board of the National Science Foundation. Taking in a cross section of 2209 adults, the survey found that scientists were rated as second on a prestige scale of professions (surpassed only by physicians) and that 70 percent of the people believed science and technology changed their lives for

the better. The good done by science and technology, according to 54 percent, outweighed the damage and a third of those polled were convinced science can solve most of our problems.

MALARIA MAY HAVE MET ITS MATCH if research with a chemical agent, Ent-61585, is successful. Working in El Salvador, American researchers use the chemical to sterilize male Anopheles mosquitoes which carry malaria. They expect the agent to be particularly effective because a male, even while sterile, can mate several times while the females can only mate once. The goal of the researchers is to tilt the balance so that there are at least ten sterile males to each fertile one.

A NEW GLUE WORKS BETTER THAN YOU'D WANT IT TO according to Medical World News which says that a fast-acting adhesive called Instant Krazy Glue binds anything to anything, including skin. The product contains an adhesive compound called cyanoacrylate which accidentally could cause a user's eyelids, lips or fingers to be glued together or glued shut.

THE UFO'S ARE BACK AND CRUISING THROUGH THE SOUTH. Responsible observers in Georgia, Florida, Alabama, South Carolina and Tennessee have reported sightings of unidentified objects described as oval or egg-shaped. Among those who made the spottings were National Park Service rangers, one of whom was an amateur astronomer. Dr. J. Allen Hynek, UFO expert, wants the government to establish an investigative body to look into the reports.

NASA TOOK ONE SMALL STEP FOR WOMANKIND recently by conducting studies on 12 women to see how they would do in space. Scientists at NASA's Ames Research Center tested the women's ability to withstand the force of gravity of re-entry, the tendency of blood to settle in their legs, and studied what specific changes occur in their bodies during weightlessness. The goal of the program is to prepare women for space travel.

IF YOU'RE HAVING TROUBLE CHEWING OR WALKING, Dr. Phillip Tobias of the University of Witwatersrand in Johannesburg, South Africa, may have the answer. He says that humans are slowly losing their small toes and wisdom teeth. The cramping effect of shoes may be forcing the little toe into oblivion, he says, while the "much-cooked food" man eats gives him little to sink his teeth into, and less need of teeth.

LETTERS

A hunter objects

Thank you for another emotional anti-hunting article ("Wild Predators in Trouble," Oct. '73). Don't mention that hunters were the first to call for seasons and bag limits. Don't mention that the fees from licenses and the hidden surtax on firearms helps to pay for wildlife management projects, salaries for game protectors, and research.

Don't associate me with those who hunt for financial reasons. The vast majority of American hunters are not sheep ranchers. Very few of us can afford a trip to Asia or Africa for a lion or tiger hunt. And frankly, I find people who wear clothing made from the skins of endangered species disgusting. Above all, most of us are dismayed by the almost total lack of intelligent discourse on the subject of wildlife.

You do predators and hunters a disservice. Instead of enlisting our aid, Mr. Caras, you alienate those who could help you the most.

JOHN SCULLIN
Dallastown, Pa.

Mr. Caras replies: *I too, have seen the flyers and brochures from hunting organizations outlining the party line telling any hunter who is feeling an attack of paranoia coming on how to reply to anyone he feels might possibly be against any aspect of hunting. Unfortunately the reader presents no new or refreshing ideas and in fact is burdened with the same tired errors all party lines always make.*

Please note in the first paragraph: ". . . hunters were the first to call for seasons and bag limits." How about "some hunters?" Wouldn't that be

more accurate? Why is it that every time a hunter hears of something bad a fellow hunter did he is suddenly a minority member. If on the other hand, it is something good—like a season and a bag limit—he becomes a "hunter," a member of the vast majority. Some hunters have been the best conservationists on this planet, others, the worst. The Dept. of Interior arrested 200 hunters this year on one stretch of road in Texas. They were returning from Mexico with illegal birds having ignored the Mexican hunting laws. D. I. got the same number on the same stretch of road last August and September. Conservationists? Two hundred hunters with over 5000 birds on 200 miles of highway in two weeks time—exceptions? Finally, if your license money pays a game warden's salary, that hardly makes you a benefactor of conservation. ■

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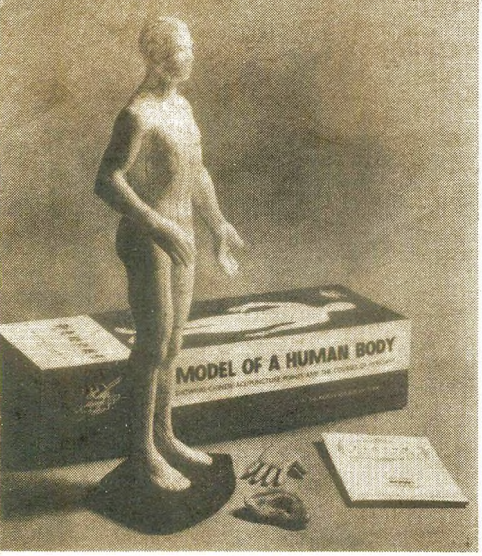


Does acupuncture really work? It's a question many physicians are busy trying to answer. In the past year this ancient art has received good reviews, often touted as a miracle cure. Far from it, report some experts who say that acupuncture is not only dangerous, but has a surprisingly low success rate as well.

WHAT ACUPUNCTURE WON'T DO

by Arthur S. Freese

IT'S NO PANACEA. It can kill. And it has lots of failures—that certainly is proven. It's true it can kill pain, but then so do placebos (sugar pills) and faith healing. Not even the Chinese use it as a panacea or as routine anesthetic. In fact, they only use it for surgery under prepared conditions. If you were wheeled into one of their hospitals right off the street as an accident or emergency victim and immediate surgery was necessary, you could expect not acupuncture but a spinal anesthetic such as you might get in any American hospital.

Let's look at acupuncture from the ground up. The beginnings of acupuncture are vague, but there is talk of it starting 5000 years ago. According to one legend, acupuncture began when a Chinese soldier was hit by an arrow in battle and noticed a sensation of numbness in a distant part of his body. Another version has it that a Chinese emperor noticed that arrows buried in his soldiers sometimes cured various ailments.

The exact origin remains undiscovered, but early acupuncture (the Latin *acus* means needle), like all ancient medicine, was a combination of philosophy, magic, mysticism and faith heeling—for virtually nothing was known of the causes of disease or even of the human body itself. Acupuncturists talk of *Yin* and *Yang* which represent the opposing forces of dark, negativism and cold and those of light, positivism and warmth. Evidently a sexist, the ancient and the current acupuncturist believes the negative Yin corresponds to women, and Yang to the men.

Disease according to this theory is an imbalance of these elements and beyond that it gets more abstruse and increasingly difficult to understand. Diagnosis was and still is chiefly made

Above, patient receives acupuncture treatment at USC School of Dentistry for previously incurable dental pains. Conventional methods had proven ineffective. Photo, opposite page shows commercially available model, which displays insertion points.

on the basis of pulse examination; but treatment has three applications—for diseases of all kinds, (the way-out acupuncturists promise help for virtually everything), for pain and as an anesthetic for surgery. Although the acupuncture fad exploded on the American scene with the suddenness of a Roman candle, it would be difficult to find physicians here who use acupuncture instead of penicillin for an infection—or patients who would accept this.

But it is in the world of pain and chronic diseases like arthritis, where medicine still provides only limited relief, that unhappy sufferers turn to acupuncture. Here the doctor himself may get swept up in the headlong rush to seize on something new which promises help by its very newness and mystery. But is there any hardnosed scientific reality concerning it? What has been recorded? What have valid studies, if any, shown about it?

Acupuncture is not harmless—it can and has proved fatal for many.

Dr. Edgar Berman, a retired research surgeon and former medical consultant to former Vice President Hubert Humphrey, observed in China an operation for acute appendicitis and the treatment of a tuberculosis patient, both using the traditional needles. "I watched them treat both these cases with acupuncture, and I saw the patients die," he says.

And in this country in one noted case, a woman died as a result of a self-administered misplaced acupuncture needle that ruptured her coronary artery, which supplies the heart muscle. Acupuncturists themselves admit that, even without hitting a nerve or blood vessel directly, improperly placed needles can kill or

inflict serious harm on a person.

Acupuncture also has been known to cause infections which are potentially fatal. New York City's Commissioner of Health, Dr. Joseph A. Cimino, is concerned over the danger of infection because acupuncturists are said to either seldom sterilize their needles or do so improperly, and there are indications that some patients have broken out in abscesses after treatments. There is particular concern over the possible spread of hepatitis from contaminated needles. Almost all American doctors and dentists today don't even trust office sterilization but use disposable needles for their hypodermic injections, discarding them after each patient.

The use of acupuncture for disease is usually ignored by American medical scientists because the talk of such things as elements, energy flow, meridians and channels is incomprehensible to Western science and there is no scientific evidence to justify it. Even Western-trained Chinese physicians are doubtful because of its many failures, such as the acupuncture treatments on Mao-Tse-Tung himself. With the best of practitioners available to him, he is reported still crippled by arthritis and sometimes hardly able to walk. Clearly Mao himself has gotten no help from the acupuncture which he forced into an uneasy alliance with modern medicine in 1958 during "The Great Leap Forward." Actually the acupuncture upsurge is heavily involved with the Chinese political scene, Mao and national pride.

But what are the facts? Only recently *The New York Times* reported how, over the last 15 years, acupuncture has been tried in medical facilities in the Soviet Union for conditions such as stomach ulcers, asthma, constipation and high blood pressure. Of some 10,000 such patients in 37 cities, 32.7 percent were "cured." Help is claimed in more than 50 percent of cases in some studies. This is identical to the percentage of patients who claim relief from any pain in scientifically controlled tests with placebos.

Increasingly there are new reports of acupuncture used for medical conditions. The late Frank Leahy, Notre Dame coach, tried acupuncture in his losing battle against leukemia; Premier Lon Nol of Cambodia received

A nurse at a Peking hospital inserts small needle in neck of patient to anesthetize him for surgery on a thyroid tumor.

it unsuccessfully for the after-effects of his stroke. A Chinese physician who treated Gov. George Wallace with acupuncture gave the opinion that the Governor might walk again. This has not happened. Yet the doctor claims some success, since: "Perhaps most significant is the improvement in the Governor's mental condition," he says.

Dr. Berman (Humphrey's one-time medical consultant) was actually trained in acupuncture by a Chinese mentor when he was Chief of the

"Acupuncture is terribly misunderstood and overrated; there's too much public hysteria over it."

U.S. Marine Corps Hospital at Peking in the mid-forties. His mentor's wife arranged for his training—in return for treating the family with Western medicine, and she used Berman's aspirin in preference to her own husband's needles for her monthly headache. Dr. Berman recalls the 30-year-long acupuncture treatment (called successful by his acupuncturist) of an opium addict who smoked at least eight pipes daily. The "success" was that on each day following treatment the addict rarely smoked more than six pipes.

At the June, 1973, Los Angeles Annual Scientific Session of the American Rheumatism section of the Arthritis Foundation, two papers were presented on acupuncture in rheumatoid arthritis. In one, Canadian investigators found that pain was relieved for a somewhat longer period than with steroids, such as cortisone, but there was an actual increase in inflammation, a symptom the steroids reduced. In short the disease worsened with acupuncture although the pain lessened. And a University of California study found there was no improvement in an arthritic patient although the needles did seem to help the pain. But so did sham acupuncture (putting the needles in the wrong places superficially, and not twirling them). The California team concluded: ". . . a placebo effect contributed at least partially to the observed analgesia [painkilling]."

It's virtually only in the relief of pain and in anesthesia that any hope is expressed by those interested in this treatment. Actually the needles *do* hurt a good deal according to objective observers who've undergone it. Many conclude that it is necessary for the effect—the old counter-irritant action such as the mustard plaster or dental poultice.

Yet there's a lot of money to be made in acupuncture. *Newsweek* reported recently that a correspondence course was being offered by the North American College of Acupuncture. Set up in a Vancouver, B. C., shopping center by a Hong Kong acupuncturist and an Australian, it charged $1650 for training, which included a trip to Hong Kong for a month of actual practice—and had already attracted 200 pupils including some 30 U.S. physicians.

One knowledgeable doctor later reported that the whole presentation, with its leading acupuncturists from around the globe, belonged in an old-fashioned revivalist meeting, not a modern scientific medical society.

One of our leading scientific acupuncture researchers, Dr. Ronald L. Katz, professor of anesthesiology at the University of California at Los Angeles, points out that "Acupuncture is clearly not a panacea nor do the Chinese, off the record, regard it as such." And Dr. Sidney Diamond, professor of neurology at New York's Mount Sinai School of Medicine, had this same experience with a visiting Chinese gynecologist who admitted that even in China no surgeon would rely on acupuncture for the pain of such diseases as terminal uterine cancer, but would turn to medi-

cation just as physicians do here.

One professor of medicine at an Eastern Medical Center has a half dozen patients who've tried acupuncture for everything from Meniere's disease to spinal disc problems with absolutely no sign of relief in any case. Another physician, Dr. John Bookman, a professor of medicine at New York's Mt. Sinai Medical School, tells of a dozen patients who've tried the needles for a variety of different difficulties from sinus trouble to bursitis. Of all these, only one claimed to have gotten help for a couple of months from the everyday pain of neck arthritis—and this 50-year-old patient was, as the physician described: "a person in whom I strongly doubt the actual presence of constant pain."

Public demonstrations too have shown constant failure. In New York City, an anesthesiologist got no relief from his broken wrist pain, and a New York State dentist in another demonstration had no easing of his pain while another got no help for his loss of the sense of smell.

A dentist (below) and two anesthesiologists perform root canal treatment on a dental patient who is under acupuncture anesthesia.

Those carrying out scientific studies of acupuncture tend to avoid publicity because of the experimental nature of the work. One such expert, a professor of rehabilitation medicine at one of our oldest medical schools, has been trained in acupuncture at Marseilles and performed more than a thousand treatments at his center here. His summary is frank: "Acupuncture is terribly misunderstood and overrated and there is too much public hysteria over it, even among the doctors. It gives no better than 50 percent success [essentially the same as the sugar pill] and it's as if you slap the face of a kid who's hurt his foot and he won't feel the pain in the foot. Moreover, acupuncture treatments have to be given over a considerable period, say two or three months—and remember, time alone may often heal."

He has also found that "the people most amenable to improvement with acupuncture are those who are highly susceptible to suggestion." This has been shown by Dr. Herbert Spiegel, a professor of psychiatry at Columbia University, and Dr. Katz, in a study in which they found that only the patients who were hypnotizable got help from acupuncture. This similarity to hypnosis is very strong in the control of pain both for disease conditions and for surgery.

Actually, repeated failures occur with acupuncture anesthesia. Only this year, Professor Marcel Gemperle, director of the Geneva Univer-

sity Institute for Anesthesiology, is said by the Associated Press to have reported to his Swiss colleagues that he and three others did not see a single case in China in which acupuncture produced complete insensitivity to pain and even saw at least one instance—a chest operation in a Shanghai hospital, on a 48-year-old man—where the patient "began to move, screamed, coughing all the time." Dr. Ian Capperauld of Edinburgh, on a medical tour of China, found that there was an indoctrination of several days needed, and that in many of the patients before surgery, various medications (barbiturates) were used as well. Emergency operations were usually done under the spinal anesthesia we use and Capperauld raises the question of which is the adjunct—the drug or the needles?

Chinese physicians themselves warn that acupuncture anesthesia should not be used uncritically, and usually heed their own warnings. In many circumstances it cannot be used, such as with children. There are often poor results with acupuncture anesthesia; it is not always complete, and in long operations the anesthesia seems to wear off as the time passes.

Reports in the Chinese medical literature are definitely inadequate by scientific standards. For example, we would not regard an incomplete anesthesia as "satisfactory." In articles, the Chinese consider "mild pain" as successful anesthesia, and do *not* list such results with pain as a "failure!" Certainly any American, doctor or patient, would regard feeling pain under anesthesia during surgery as a distinct failure of either technique or anesthesia.

Most medical scientists here feel that while acupuncture may work for

Here a patient gets zapped with an acupuncture needle, her face showing considerable discomfort. A Swiss doctor reports that in China he saw a patient screaming and coughing as physicians twirled needles into him.

certain pains, it is still only an experimental technique in their eyes, and Dr. Diamond points out that a patient should not be charged for it under these circumstances. Perhaps if this were done, there would be a lot less acupuncture carried out. Finally, there is no scientifically accepted proof that acupuncture is any better at relieving pain than any of the many other ways available today, and that the same overall results cannot be achieved with different and well-tried methods. These conclusions elicit new perspectives about the validity of acupuncture.

Remember that careful scientific studies have shown that even sugar pills can relieve up to 50 percent of pain; that the power of suggestion can relieve the pain following surgery and even that of cancer. The plain fact is drugs have been doing well by pain for more than a century. All trained observers are agreed on one thing—that final proof is many years off and today's acupuncture patient in America is in many ways only a guinea pig, so perhaps you should think twice before spending your money to get needled. ■

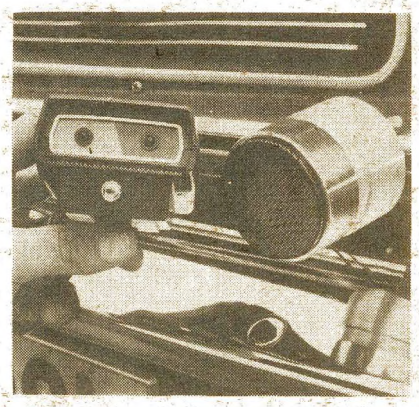
TECHNOLOGY SPIN-OFFS FOR YOU

Coolite—chemical light source

Model Christina Schneider demonstrates Coolite, a chemical light source that lasts about three hours and supplies enough light for reading, changing a tire or other emergency uses. Coolite is activated by bending the tube until a smaller internal tube containing a chemical activator is broken. The tube emits a bright greenish-yellow glow after being shaken a few times to mix the two chemicals inside. Coolite comes with a removable aluminized reflector which concentrates its glow into a broad beam.

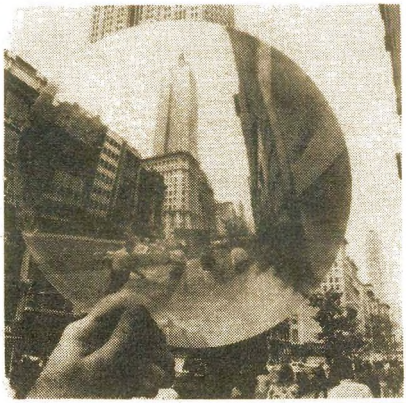
Fog sniffer warns motorists

In 1970 in England ten people died in a multiple car crash caused by fog. The next day inventor Joe Dawson set up Vibrotec Products Ltd., whose purpose would be to develop and produce a fog sensor that could be easily installed in a car and would warn the driver of any highway fog within five miles. Today Dawson has finally come up with a workable device: a sensor probe (shown at far right) is fitted near the car's bumper and sends fog signals to a control console on the dashboard (hand-held, near right).



Device catches obscene callers and other phone criminals

A new system from Telident Inc. connects to any telephone and displays the incoming caller's number. Its purpose is to help catch obscene and other objectionable phone callers. The caller's number and exchange remain visible throughout the call; this pinpoints any phone being used for the obscene call, whether it's a private or pay phone. The maker says the system will also discourage those making bomb threats or ransom demands, if you are bothered with these problems.



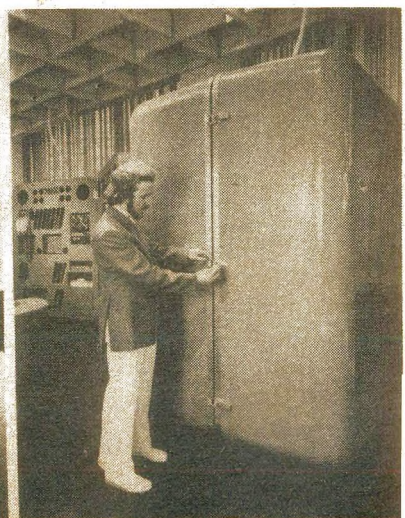
BIPS

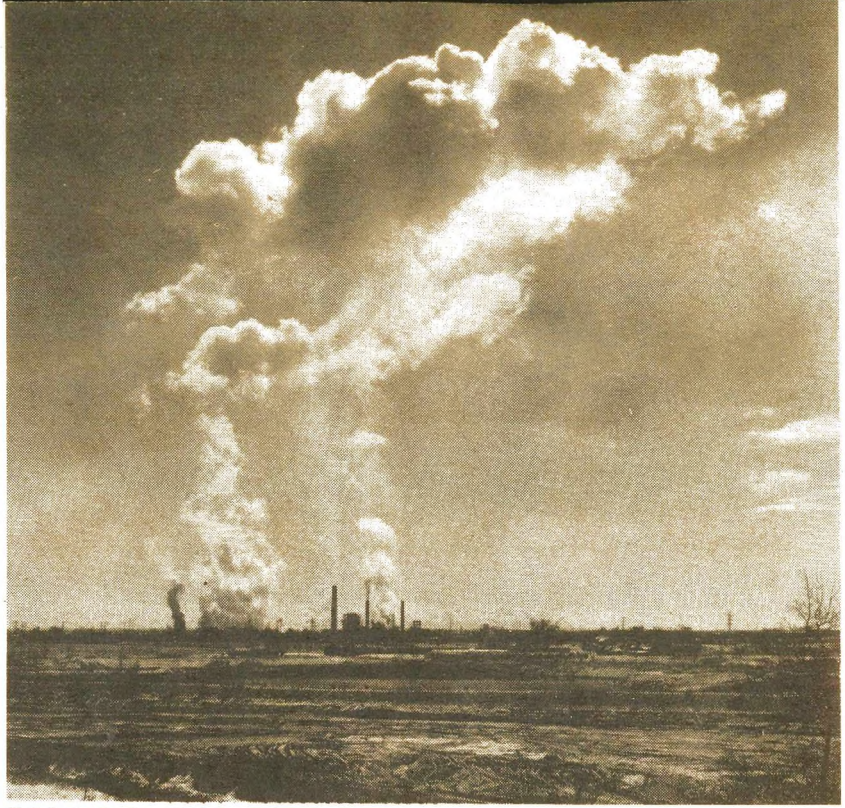
Wide-angle view of the world

The Empire State Building is viewed at left from a very close angle, yet the entire skyscraper can be seen in this 10½-inch flexible disc from Japan. Costing only a few dollars and made of plastic, this wide-angle Fresnel lens is meant mostly to be used as a fun object to look at the world through, but the makers insist that you could place the disc in front of a normal camera lens and end up with wide-angle photographs. The discs come in five colors, too: pink, blue, yellow, red and green.

Bedroom folds into giant rolling suitcase

The bedroom (below, left) folds up into a giant suitcase (below, right) on rollers. The foldable bedroom is just part of a display at the Owens-Corning Fiberglas Center display in New York that also features a foldable dining room and livingroom (or entertainment room). The concept was developed by designers Alan Buchsbaum and Howard Korenstein of Design Coalition to meet various changing trends in American life—the main one being the desire for easy mobility. The bedroom below opens to sleep two on a fold-out double bed and has drawers, a clothes rod and closet for storage of personal items. The entire unit is lined with Fiberglas fabric. The entertainment room houses a communications wall, which contains telephones, television sets, video tape recorder, tape deck and record turntable. The seats can be moved around and there is a plant area equipped with fluorescent lights that simulate sunlight. The dining room contains a retractable table, bar and storage tables, and chairs.





Nat'l Center for Atmospheric Research

We're changing the weather by accident

Scientists can't agree whether we're heating the earth up or cooling it down. But one thing seems certain: drastic weather changes—hail and thunderstorms—are suddenly appearing in some communities. The culprit is pollution.

by Henry Lansford

IS MAN changing the weather? Speculation on this subject, ranging from cautious scientific conjecture to apocalyptic warnings of doom by flood or ice, has been going around for years.

Dr. Stephen H. Schneider of the National Center for Atmospheric Research explains that on a global level there are two main theories: One, that air pollution will eventually increase the temperature of the earth thus melting the polar ice caps, raising the oceans enough to drown New York, London and other coastal cities. The second theory says just the opposite—that we're in for a long-term cooling trend which might cul-

minate in a new ice age as soon as the year 2000. How can there be two theories with such opposite conclusions?

Dr. Schneider explains that there are so many variables in the atmosphere that scientists can reach diverse conclusions depending on what evidence they look at. The first theory is based on the "greenhouse effect." Like the glass roof of a greenhouse, atmospheric carbon dioxide is transparent to incoming short-wave solar radiation but absorbs the long-wave infrared energy that is radiated back upward from the earth's surface. In other words, carbon dioxide lets the heat in from the sun and then insulates it after it hits the earth.

Photo opposite shows small cumulus cloud triggered by release of heat from electrical generating plant. Below, chemists take air samples in the Amazon jungle to determine if deforestation can affect global climate.

NCAR

So obviously, if you increase the carbon dioxide, you increase the heat in the atmosphere. And that, say "greenhouse" theorists, is exactly what is happening. Man has been putting carbon dioxide in the atmosphere by burning fossil fuels such as coal and oil. One calculation suggests that doubling the amount of atmospheric carbon dioxide would increase the average surface temperature of the earth by about two degrees Kelvin.

The second theory, according to Schneider, is based on the idea that an increase in dust and smoke particles in the atmosphere from industry and agriculture could change the earth's albedo—the ratio of the amount of radiation reflected by the earth to the amount falling on it—thereby screening out some of the incoming solar radiation. Some scientists thus have speculated that this might result in a long-term cooling trend, and a few incautious prophets have forecast a new ice age by the year 2000.

However, at a meeting of the American Association for the Advancement of Science, Schneider refused to forecast any global catastrophes. Instead, he maintained that: "Before we can evaluate the inadvertent consequences of man's activities on the weather or climate, we must first have good working models that can explain the natural variability in weather."

Present models of atmospheric behavior, says Schneider, are not sophisticated enough. They do not in-

NCAR

Urban pollutants, such as the ones that created this gray pall of smog over the St. Louis skyline, may have other effects not so readily seen. Scientists are finding strong evidence that urban pollution can change weather for considerable distances downwind from the city.

clude the feedback mechanisms and coupled effects that play major roles in the complicated interactions that determine the behavior of the real atmosphere.

Schneider himself has used models. Along with his colleague, S. I. Rasool of the Goddard Institute for Space Studies, he employed an atmospheric model to calculate that an increase in atmospheric particles would alter the albedo of the earth. He found that the model could yield only tentative results.

On a smaller scale, man's impact on the atmosphere has been documented much more positively. The urban "heat island" effect is well known—large cities are consistently warmer than the surrounding countryside, both because of the heat-retaining properties of concrete and asphalt and because they contain many sources of heat energy such as electric generating plants.

There is increasing evidence that cities also can affect the weather for some distance downwind from the urban complex. An example is the strange case of La Porte, Indiana. Several years ago, Stanley A. Changnon, Jr., a climatologist with the Illinois State Water Survey, was analyzing precipitation data related to water supplies in Illinois. Looking at rainfall records for areas that provide runoff for Illinois streams, he noticed that the weather station at La Porte, Indiana, seemed to have unusually high figures in recent years. Some time later, studying records of thunderstorms and hail over the Midwest,

Changnon noticed that La Porte also seemed to have more than its share of those phenomena.

A careful analysis of the La Porte records revealed that, since 1925, La Porte had shown a precipitation increase of between 30 and 40 percent. Between 1951 and 1965, La Porte had 31 percent more precipitation, 38 percent more thunderstorms, and 246 percent more hail days than nearby weather stations in Illinois, Indiana and Michigan.

Reporting on this anomaly at a national meeting of the American Meteorological Society in 1968, Changnon said: "Because La Porte is 30 miles east of the large complex of heavy industries at Chicago, there is a strong suggestion that the increases are due to inadvertent man-made modification."

He pointed out that the precipitation increase in La Porte closely followed the upward curve of iron and steel production at Chicago and Gary, Indiana. Furthermore, La Porte's runs of bad weather correlated closely with periods when Chicago's air pollution was bad. Stated simply, Changnon's theory was that the heat and moisture belched out by industrial smokestacks stimulated the formation of cumulus clouds over Chicago. Prevailing westerly winds carried the clouds across the tip of Lake Michigan, where they picked up more water. By the time they got to La Porte, they were big and heavy with moisture. Pollutants from the industrial sources served as nuclei to trigger precipitation, just as silver iodide crystals are used to seed clouds in deliberate efforts of weather modification.

Although Changnon's case for the reality of this phenomenon, which he called the La Porte Weather Anomaly, was convincing, it was based on circumstantial evidence. Some climatologists have attacked its validity on grounds ranging from possible errors by the weather observer to the lack of corroborating physical evidence to support the circumstantial link between Chicago's pollution and La Porte's bad weather.

At the 1973 annual meeting of the American Meteorological Society, however, Changnon and a colleague presented new evidence to support the hypothesis that cities can affect the weather downwind.

In a paper co-authored with Changnon, Richard G. Semonin, also of the Illinois State Water Survey, presented the results of two years of work in a project known as the Metropolitan Meteorological Experiment, or Metromex. A five-year field investigation of urban effects on weather, Metromex is still being conducted in the vicinity of St. Louis, Missouri. The Illinois State Water Survey is one of several participating research groups; others are Argonne National Laboratory, Battelle Northwest Laboratories, the University of Chicago, Stanford Research Institute and the University of Wyoming.

According to Semonin, the Illinois State Water Survey undertook its part of Metromex to test the hypothesis that grew out of the La Porte study and similar situations.

"When our climatological studies persistently indicated weather anomalies associated with large cities," Semonin said, "we decided it was time to make concentrated measurements and analyses of an actual city. We wanted not only to prove or disprove that an urban effect existed, but also to find out how and why."

To get the how's and why's, the researchers began in 1971 to install a network of instruments over a 3800-square-mile area in and around St. Louis. This network has 250 sites where rain, hail, and related weather conditions are measured. Two types of weather radar systems and an instrumented aircraft are used to probe the atmosphere in the research area. These facilities have provided highly detailed descriptions of precipitation and severe weather events in the city and the surrounding areas, Semonin explained.

"The first two years of this study has given us proof of a few things and has pointed out the important questions yet to be answered," he recently told an audience of meteorologists in St. Petersburg, Fla.

First, the researchers found that rain, thunderstorms and hail actually do maximize at locations 10 to 15 miles downwind from St. Louis. Such locations have more storms, and they are more intense, last longer and produce more rain and hail than storms in the surrounding region.

Second, they found some clues to the mechanisms involved in this anomaly. It appears that air which has been heated and polluted by the city does move up through the atmosphere high enough to affect clouds. This urban-modified air, according to Semonin, clearly adds to the strength of convective storms and increases the severity of precipitation. A light cumulus formation could conceivably turn into a heavy thunderstorm.

"The next step in Metromex is to determine the specific role that various urban factors play in bringing about the effects that we have observed," Semonin said. "We need to know the relative importance of changes in heat, moisture, air turbulence and the amount of particles in the air."

Many atmospheric scientists feel that the sort of research that is being done in Metromex on the scale of a single city must be expanded to consider much larger regional and global questions. Dr. Schneider cited a project that has been proposed by Professor Reginald Newell of the Massachusetts Institute of Technology—studying the possible effects of deforestation on the Amazon Basin. The Amazon rain forest, located in a region of prevailing upward atmospheric motion, puts sizable amounts of moisture into the atmosphere. If it were shown that this region is responsible for a large fraction of the moisture that gets into the atmosphere and that deforestation could seriously affect the energy balance of the atmosphere in the equatorial regions, then there would be a significant possibility that clearing the Amazon rain forest would affect the climate elsewhere.

"Would that mean," Schneider asks, "that the Amazon countries would no longer have the right to plan the use of their own lands? Do the industrial countries have the right to put smoke in the air if it is changing the albedo of the earth? Do Canada and the Soviet Union have the right to divert rivers away from the Arctic Basin, eliminating a fresh-water source from the Arctic Sea, which might cause an increase in the salinity of the Arctic surface waters, which could then result in the removal of the Arctic Sea ice cap with possible dire (or beneficial) but as yet unknown consequences to global climate?"

Schneider maintains that these questions will certainly have to be

Henry Lansford

Global circulation of the atmosphere begins in the tropics, driven by energy transferred from the warm oceans into the stratosphere by tropical storms, like this one, off Barbados.

answered in the next few decades, because man's influence on the atmosphere, through release of energy and human alteration of the face of the earth, "may soon become large enough to rival nature's."

Looking a decade or two into the future, when scientists should be able to say with some authority what effects human activities are having on the atmosphere, Schneider sees a great need for international dialogue and cooperation.

"Since the atmosphere/ocean system is a resource shared by all the world's inhabitants, and since it is a tightly coupled system, possibly subject to serious irreversible changes," he says, "one thing seems clear: the time is at hand for *all* nations to agree to avoid, without the consent of the other affected parties, engaging in any enterprise, civilian or military, that could significantly affect the climate elsewhere on earth."

The common theme that emerges from these two scientists—Schneider, who has studied what is known and what is not known about man's impact on the atmosphere, and Semonin, who has tested out the atmosphere of a specific city—is that in meteorology as in ecology, everything is connected to everything else. If we are to find sane and intelligent answers to some critical environmental questions that will face us in the next few years, it appears that we need to know a great deal more about the atmosphere of our planet than we know now. ■

What's an American Indian language doing in Africa?

by Nels Juleus

Selected Vai and Cherokee Characters

English syllable	Vai	Cherokee
ma		
mo		
mu		
sa		
so		
mba		–
dla	–	
dzu	–	
ngo		–
wa		
we		
da		
de		
di		
do		
du		
ka		

ARCHAEOLOGISTS and anthropologists are always finding evidence that languages spoken and written on the American continents were not developed by the indigenous American peoples, but taught to them by unknown visitors from Europe or Africa.

Now proof of the opposite has been found—an African language that's similar to the American Cherokee language; and all evidence points to the conclusion that the Cherokee language was developed first and transported to Africa, not the other way around.

The story begins in 1848 when a British naval officer, Lt. F. E. Forbes, wrote excitedly to his commander:

"I have discovered something of great importance for an understanding of African civilization. I have discovered a *written* language indigenous to sub-Sahara Africa." Forbes had searched the west coast of Africa for evidence of such a language. His diligence was rewarded when he found a few indistinct characters written in charcoal on the wall of a house in Cape Mount, Sierra Leone. Finally, on January 18, 1849, he was able to report that the Vai people had a writing system.

The Vai, who speak a Niger-Congo language of the Mande sub-group, live in the southern tip of Sierra Leone and the neighboring part of Liberia. Their 200-character syllabary was invented by Momolu Duwalu Bukele and at first seemed unrelated to any known script.

Bukele, while serving as a messenger for slave traders, had become deeply impressed with the idea of written message exchange. In a writing system, he saw a means for Vai liberation, a way to equalize the differences between Europeans and Africans. When he was about 25 years old, Bukele had a dream in which he saw a tall, aged white man. This God-like figure handed him a book and said to him, "I am sent to bring this book to you, in order that you should take it to your people. However, I must warn you that those who become familiar with this book must not eat the flesh of dogs and monkeys, nor of anything found dead whose throat has not been cut, nor to touch the book on those days on which you touch the fruit of the pepper tree."

Bukele was shown by the white man of his dream how to write the words of the Vai language. In the morning, Bukele reported his dream to his brother and four cousins. He could recall only a few of the signs but the divine nature of the vision persuaded the six men that they could create a written language. This they proceeded to do.

But recently, anthropologist Svend E. Holsoe, of the University of Delaware, explored the suggestion made by the editor of the *Missionary Herald,* who noted the striking resemblance of Vai to the Cherokee syllabary invented by Sequoya in 1821. Holsoe supports this hypothesis by establishing that a Cherokee by the name of Austin Curtis emigrated to Liberia in 1823. Curtis, who settled in Vai country and married the daughter of a chief, may have been the figure in Bukele's dream.

If Holsoe's hypothesis stands, it will provide an unusual instance of the influence of the Cherokee on an African culture. ■

Chart at left shows graphic similarities between African Vai syllabary and that of the Cherokee Indians. In a syllabary, a symbol represents a consonant and vowel.

GEOLOGY

How the Mediterranean Sea dried up

Geologists have found evidence that the Mediterranean Sea some six million years ago was nothing more than a vast dried up sea bed. It seems that geological forces had somehow damned up the Atlantic "spigot" near Gibraltar.

by Gordon Graff

IF YOU WERE to scan the view from aboard a ship sailing in the middle of the Mediterranean Sea on a clear, sunny day, you would no doubt be enthralled by the shimmering, deep blue waters stretching outward toward the horizon. But if you could have been in the same spot some six million years ago, a strikingly different vista might have greeted your eyes. You would have seen no deep blue water—or any water. For the Mediterranean, previously a sea as deep as today's, had by then dried up into a vast, scorching desert whose bottom plunged as much as two miles below present sea levels.

Try to picture the bleak world of the drying Mediterranean. Year after year, inch by inch, the waters slowly ebbed under the steady gaze of a merciless sun. The shores of the dying sea must have been littered with dead fish and other marine creatures unable to survive in waters that grew increasingly salty. Eventually, the last stagnant, salt-choked pools dwindled to nothing. As century after endless century slid by, the former ocean bottom lay bare—a barren, parched wasteland where windswept sand dunes and brittle, cracked salt flats baked in the blazing heat.

After the drought came a flood that must have dwarfed the mightiest floods known to history. Water thundered in from the Atlantic Ocean over an immense waterfall at the present site of Gibraltar. And what a waterfall that must have been! It may have had a volume 1000 times as great as Niagara Falls and 100 times as great as Victoria Falls according to an estimate by Dr. Kenneth J. Hsü, a geologist from the Swiss Federal Institute of Technology in Zurich. Even at this prodigious rate, the colossal cascade would have taken more than 100 years to refill the Mediterranean basin. "As much as five percent of the world's ocean water must have passed over that waterfall," says Dr. William B. F. Ryan of Columbia University's Lamont-Doherty Geological Observatory.

What caused the Mediterranean to dry up in the first place? According to Dr. Hsü, the ancient Mediterranean received much of its water from the Atlantic Ocean by way of the narrow Strait of Gibraltar just as it does today. About six million years ago, this natural floodgate was closed by geological forces, shutting out the Atlantic waters. As a result, the remaining water in the sea disappeared virtually

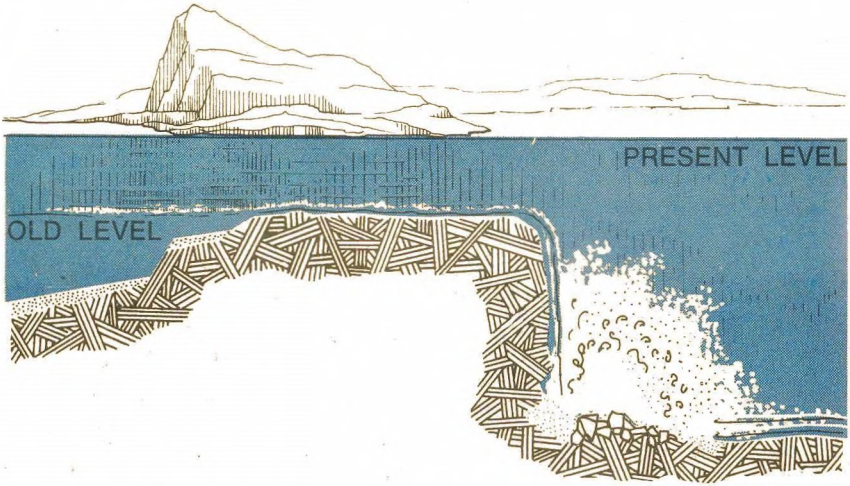


Illustration by Tom Minker

Diagram depicts present level of Mediterranean in contrast to its earlier level at the close of the Miocene epoch some five million years ago. At that time, the geological forces that held back the Atlantic broke, and a giant waterfall near Gibraltar refilled the dry sea bed.

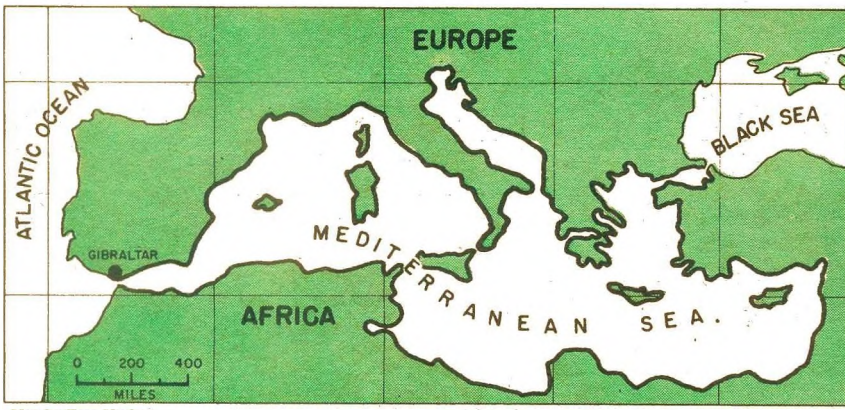
overnight. (If the Strait of Gibraltar were closed today, claims Dr. Hsü, it would take a mere thousand years or so for the Mediterranean to evaporate completely.)

Astonishing claims made

These dramatic revelations about the prehistoric Mediterranean are the fruit of a two-month cruise in the fall of 1970 aboard the deep sea drilling vessel *Glomar Challenger*. On the expedition, scientists bored numerous holes into the floor of the Mediterranean and brought up core samples for study. After painstaking analysis of these samples, Drs. Ryan and Hsü, who headed an international team of scientists and technicians on the expedition, made their astonishingly offbeat claim that the deep Mediterranean basin had once been dry from end to end.

"Fantastic. Incredible. Like science fiction." These are some of the ways Dr. Ryan described his first reaction to this notion. "As a working hypothesis, we were reluctant to propose it ourselves," says the young, affable geophysicist. "It contradicted the great axiom of geology: don't call on explanations for past events that you don't see at work today." And to be sure, there are no dried up deep ocean basins around these days.

Even more incredible was the discovery by the *Glomar Challenger* scientists that the Mediterranean dried up not just once, but many times. These bizarre and turbulent episodes of dry spells punctuated by catastrophic floods all occurred in an era in the earth's history known as the Miocene epoch, a period that ended about 5.5 million years ago in one final deluge that swept away the dam at Gibraltar and refilled the Mediterranean basin to the level it's remained at ever since.



Map by Tom Minker

The theory that the Mediterranean was once a dry land mass has led to speculation about migrations of some animals (horses, hippopotamus, monkeys) from Africa to Europe. The spread of plains in Africa may be related to rainfall patterns that came with dry-up.

What evidence led to this heady picture of burning deserts, towering waterfalls and cataclysmic floods? Fortunately, these events of long ago have left behind a natural chronicle which scientists have only recently begun to decipher.

The first clue to the Mediterranean's strange past came in the early 1960's when investigators bounced sound waves off its bottom. This method, called seismic profiling, enabled them to tell from the reflected sound waves the nature of the ocean floor. By using this technique, scientists were able to show that beneath the soft ooze of the ocean bottom lay a peculiar, hard deposit. This deposit seemed to underlie much of the floor of the Mediterranean.

To Dr. Ryan, a participant in these early expeditions, the hard deposits resembled a familiar phenomenon: salt domes. Salt domes are huge pillars of salt formed by evaporation of water from ancient seas. However, they are normally found at the bottom of shallow coastal waters such as the Gulf of Mexico. What would they be doing on the abyssal plain (or deep ocean bottom)?

To probe the baffling question of what the deposits were and how they got there, a group of investigators organized the *Glomar Challenger* expedition. In drilling about 100 miles southeast of Barcelona, Spain, researchers made the first of several exciting discoveries. They came across a mysterious sample of gravel: mysterious because gravel on the ocean floor ordinarily contains minerals washed down from land; but this sample was oddly free of such minerals. Instead, the gravel seemed to come from a dried up ocean bed.

Another discovery which set off a flurry of excitement came when the *Glomar Challenger* crew found a mineral called anhydrite beneath the sea bottom. Anhydrite, which chemically is composed of calcium sulfate, belongs to a class of minerals geologists call evaporites. Evaporites, as the name implies, are formed by the evaporation of water from shallow

tidal pools containing dissolved minerals. Clearly, the bottom of the Mediterranean must at one time have been shallow enough to deposit such minerals.

As the expedition progressed, the crew brought up other evaporites from widely scattered sites in the Mediterranean. These samples all seemed to date from the late Miocene period (about six million years ago). The evaporites accounted for the hard, sound-reflecting layer that seemed to line the bottom everywhere.

Two further discoveries helped clinch the argument for a dried up sea. In the first of these, scientists found samples of a rock called stromolite under the sea floor. Stromolites are fossils of minute plants called blue-green algae. These plants require shallow water and sunlight to grow in.

In the other find, the crew dredged up ordinary salt (sodium chloride) from one of the deepest spots in the Mediterranean. Geologists on board could tell from its crystalline form that the salt must have been laid down by the evaporation of some ancient brine pool. One salt chunk even had a crack in it that must have been formed when it dried under a hot sun eons ago.

The sum total of the evidence was impressive indeed. As Dr. Ryan says, "Everywhere we looked, the samples said to us: 'shallow water and sunlight'." Clearly, the evaporites, the salt and the other deposits couldn't have accumulated in the dark, cold reaches of a deep sea bottom.

One question lingered in the minds of the *Glomar Challenger* scientists: Was the bottom of the Mediterranean as deep when it dried up as it is now? Maria B. Cita, a paleontologist from the University of Milan, discovered fossils that proved that it was. The fossils she examined showed that the Mediterranean had been a deep ocean environment immediately before and after the dry spells. How could this very sudden transition have occurred? Did the sea bottom rise and fall thousands of feet in a short time like some geological bucking bronco? Or did the water level rise and fall? To Drs. Ryan and Hsü, the latter was the only plausible explanation.

Geographical clues

The new theories about the Mediterranean help explain many previously unfathomable scientific mysteries. For example, geologists have long known about a buried gorge under the bottom of the Rhone River in southern France, but have always puzzled over its origin. Now an explanation can be offered: the gorge was cut by the Rhone when it surged with renewed vigor into a newly dried up Mediterranean. The gorge was later buried under sediments that deposited when the sea level rose again.

In Egypt, geologists have uncovered similar but more spectacular findings. For example, under the bed of the Nile River, near the site of the present Aswan Dam (about 800 miles upstream), is a gorge some 700 feet below sea level. This gorge is buried under the sands and silts of the river bottom. In addition, a Russian geologist named I.S. Chumakov, after making test borings, has concluded that beneath the sandy marshes of the mouth of the Nile lies buried a vast canyon as majestic as the Grand Canyon. Both the gorge and canyon were probably sculpted by the Nile when it plunged into a Mediterranean that was many feet lower than today.

Surely, something as cataclysmic as

the drying of the Mediterranean must have left some imprint on the living things on land. During the Miocene epoch, says Dr. Ryan, "we find that the horse enters Spain from Africa. The hippopotamus suddenly appears in Cyprus. In Africa, monkeys evolved from tree-dwelling forms into species are able to survive on the plains."

A vast land bridge?

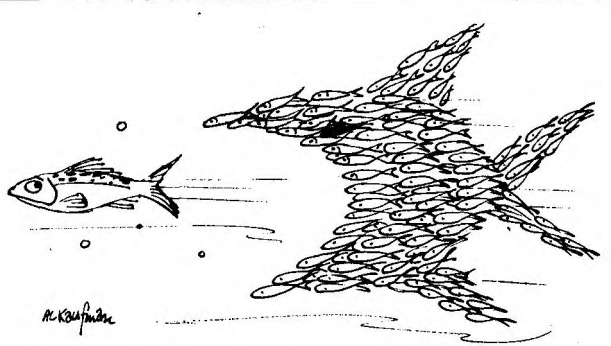
Dr. Ryan believes that horses may have crossed into Spain over a land bridge that once existed at Gibraltar. Obviously, the only way the hippopotamus could have entered Cyprus—an island in the middle of the Mediterranean—is via a dry land route from Africa. The spread of plains in Africa may also be related, claims Dr. Ryan to a change in rainfall patterns that accompanied the drying of the Mediterranean.

In short, during the time the Mediterranean dried up, there was a drastic decrease in rainfall also. This led naturally to the decline of Africa's forests and the subsequent spread of plains. At this time, man's timid ape-like ancestors were crowded out of the shrinking forests and forced to venture forth to a life on the plains. It was probably on these primeval African plains that these apes turned from their former vegetarian habits to a hunting, carnivore existence. And it was from these hunter apes that first man is believed to have arisen. Thus, asserts Dr. Ryan, it is not too far-fetched to speculate that the drying of the Mediterranean may have led to the rise of man.

The drying up of the Mediterranean is more than just the story of an awesome spectacle from the earth's past; it bears heavily on contemporary issues. If the mere closing of a narrow strait could cause an entire sea to dry up and change the course of evolution to boot, think what man's careless tampering with the environment can cause. Clearly, it is critically important to know in advance the possible global consequences of seemingly trivial changes in the land, sea and air around us. In a real sense then, information gleaned from a prehistoric ocean bed may hold the key to our continued survival on this planet. ■

For further reading

"Mediterranean Sea—Evidence for dessication in the Late Miocene." By K. J. Hsü, W. B. F. Ryan, and M. B. Cita. Nature. *Vol. 242, March 23, 1973. p. 240.*



Big boom in torture technology

FOR THE JOB hunting doctor, behavioral psychologist, pharmacologist or electrical technician who has few scruples there's a new field of science looking for specialists, the field of human torture. *New Scientist* magazine reports that sophisticated techniques of human torture are now part of government policy in over 30 countries and they employ specialists in many fields of science to administer them.

The hardware of the modern torturer makes the Rack and the Iron Maiden look crude and messy by comparison. In Brazil one device is an interrogation room equipped with speakers and a television screen used to create a sound and light show which is designed to drive a victim to the point of a nervous breakdown. In one torture session images of the victim's family were interspersed with those of approaching high-speed trains, dizzying blasts of strobe lights and the sounds of piercing screams.

Technology does its part with devices like the piquada (an electrified straight pin inserted under the fingernail), a combination dental drill and electroshock apparatus used in a victim's mouth in what is called the "mad dentist" torture, and the Mitrioni vest named after its alleged inventor, an American AID official. The device is an inflatable vest in which the pressure can be increased to the point of crushing a victim's rib cage.

Drug torture is probably the most diabolical. By carefully organizing their injections, torturing doctors or pharmacologists can control a wide range of pain and euphoria or can simply force the body awake for more torture. In Uruguay doctors use a two-part series of sodium pentothal (the "truth drug"), and taquiflexil, a curare-based drug that causes agonizing muscle contractions. While alternating the euphoria of the sodium pentothal with the pain of taquiflexil, doctors try to elicit information from their patients.

A favorite drug in Russia is aminazin that induces a maddening restlessness in the victim. This treatment may also be combined with the practice of finding certain dissident Russians insane and committing them indefinitely to asylums.

Investigators tracking down the source of some of these tools and techniques have named the United States as a major exporter of torture equipment and training center for police from Saigon, Uruguay and Brazil where the tortures used are remarkably similar. In each case these police had attended the International Police Academy in Washington, D.C.

The ultimate blame for the new

look in torture, however, rests with those scientists who provide their expertise and develop the techniques for this official sadism.

Sloths are lazy

Anyone who's seen a sloth in action at a zoo knows that they're about as exciting as a bowl of cold oatmeal.

Now to see if their laziness is just skin deep, two biologists, James Toole and Theodore Bullock, began to examine the sloth as mammal.

And as a mammal it's a failure. Not only does a sloth not maintain constant body temperatures except when pregnant but it can stop breathing without doing any damage to its heart and brain.

Its reflexes are equally odd. It will not jump at a loud noise and when dropped makes no attempt to right itself but flops to the ground like dead weight.

Even its meals move in slow motion. It takes an average of two weeks to travel from one end of it to the other.

The sloth also has a peculiar set of muscles, most of which are powerful flexor muscles and few are extensor muscles. In part because these muscles are incapable of rapid contractions and in part because its central nervous system is not geared for rapid contractions, the sloth's life is in perpetual slow motion.

Nodule prospecting

Enterprising prospectors have given up looking for valuable metals on dry land and instead have begun prospecting in the ocean.

The reason, according to *Newsweek* magazine, is that there are areas of the ocean bottom covered with nodules rich in manganese, copper, nickel and cobalt that have settled out on natural debris on the ocean bottom over millions of years.

Some experts say that there are billions of tons of the manganese-rich nodules that may well be the world's next source of metals.

Companies have already developed techniques for dredging or vacuuming up the nodules and scientists are confident they can efficiently process and refine the metal-rich lumps. And one ship has already begun nodule mining operations.

This potential has great appeal for nations like the United States who must buy all but one of the metal components of the nodules from other countries. It also sets the stage for a global conflict about who has the rights to mining these minerals in international waters.

Insanity helps poetry

If you plan to be a poet, you might consider going crazy to help your career. After a survey of 52 English and French poets, Colin Martindale of the University of Maine said that most of them were mentally unbalanced in some way and many had lost their fathers at an early age.

In his research Martindale found 55 percent of the poets he examined identified with their mothers, 30 lost a father at an early age, almost 50 percent were psychopaths and 15 percent were psychotic.

Keats, for example, lost his father at age eight, was a chronic hypochondriac who suffered from bouts of despair and had uncontrollable fits of

laughing and crying. Byron, who lost his father at two, was extremely paranoid and never left the house unarmed.

Shelley had chronic hallucinations of being attacked by a man with a pistol and the French poet Corbiere liked to make elaborate model boats and then demolish them.

Fortunately these men were better at poetry than living normal lives. Martindale thinks this was because their mental illness forced them to regress to early years when imagery was strong and powerful.

A black hole pays a visit

As a possible explanation for a spectacular amount of damage caused in Siberia by something from outer space, two American physicists say that the earth was pierced by a black hole.

Residents around the sparsely populated Tunguska region in Siberia reported in 1908 seeing a large pillar of fire and heard what sounded like several explosions. For 20 miles around the site of impact trees were levelled, horses were knocked down 400 miles away and the shock waves were recorded as far away as Washington, D.C.

Although this was referred to as the Tunguska comet, not all scientists agreed. Some claimed it was a meteorite of antimatter that exploded on contact with atoms of matter in our atmosphere; others said that it might even have been a nuclear device aimed at the earth by an advanced civilization.

A. A. Jackson IV and Michael P. Ryan, Jr., working at the University of Texas, now have postulated that what actually did all that damage was a black hole about the size of a fleck of dust, weighing about a million billion tons and travelling at about 25,000 miles an hour. Black holes are objects collapsed to extremely small sizes and have tremendous densities.

The physicists say that such a black hole on entering the atmosphere would have caused shock waves and a fiery blue column and they estimate it would have passed through the earth and out the other side at a point in the North Atlantic.

To check on their theory, Jackson and Ryan plan to check meteorological records and other sources of information that would have noted a peculiar disturbance in that North Atlantic area.

New hope for drunks, fatties

There may still be hope for the heavy drinker or eater even after he's taken his twelfth drink or eaten his fifth dessert.

Dr. Cleamond D. Eskelson of the Veterans Administration Hospital in Tucson, said that sodium acetate, a salt of acetic acid, can slow the absorption of alcohol and food into the intestinal tract.

In tests with rats Dr. Eskelson and other researchers found that the body uses acetate in what is termed a feedback system regulating the absorption of alcohol. As alcohol is released from the stomach and absorbed by the body it eventually reaches the liver which produces acetate. This acetate circulates back to the stomach where it inhibits the release of alcohol.

By adding even more acetate mixed in with the alcohol the rats drank, the scientists noticed a decrease in blood alcohol.

This same check-release action, Eskelson said, can be applied to food

as well. For that reason it could also prove invaluable as a chemical safeguard for overweight people with cardiovascular disease as well as treating alcohol abuse.

X-ray sees all brain levels

A totally different X-ray technique now permits doctors to get finely detailed images of the brain on almost any horizontal level.

Developed by a British firm, the unit, called an EMI scanner, scans the brain from above and feeds this information into a computer which produces a printout of the scan and a picture on a cathode-ray tube. The picture can be preserved with a Polaroid camera for future reference.

The unit has tremendous advantages over conventional systems. The computer makes a finer reading of X-rays and produces a more detailed brain image. The scanner allows technicians to look at the brain in horizontal cross sections allowing doctors to see the depth of a tumor at different levels. It produces results in less than 30 minutes and needs none of the complicated patient preparation that conventional brain X-rays demand.

Sterilizing abortion patients

Women who go to a hospital or clinic for legal abortions may get more than they bargained for.

Writing in the *Journal of the American Medical Association,* Dr. Edgar B. Keemer, Jr. pointed out that in some places woman patients are pressured into allowing a doctor to sterilize them as well as perform the abortion.

"In many parts of the country," he wrote, "tubal ligations are being performed casually, concomitant with legal abortions both in hospitals and in independent clinics."

He went on to tell how a noted gynecologist remarked before abortion was legalized that he would refuse to perform an abortion unless the woman also consented to sterilization.

The fine art of disambiguation

People translate, computers disambiguate and the Air Force has been doing a lot of disambiguating lately.

Computer experts working for the U.S. Air Force have been able to educate computers with sufficient fluency in Russian to translate technical papers in 12 fields of science and technology. Air Force sponsored programs are also underway to develop German-English and Chinese-English programs, all in technical areas.

The main advantage of computer translation is speed. A computer can translate 100,000 to 300,000 words per hour, or about 14 million words each year, in imperfect but understandable English which is post-edited by men.

According to *The New York Times,* designing a program to handle the ambiguities of language (even that used in technical papers) takes an average of about five years. As far as literature goes the results can be less than inspiring and still require the human touch. For example, when the key phrase of the Communist Manifesto, "Workers of the world unite" was run through a computer in the original Russian the result was "Proletarians of all the world, get connected."

Setting up a translating program involves the basics of learning a new language. A lexicographer prepares an information base of foreign words

of stem and compound form, their equivalents in English, and pertinent information on syntax and semantics. This is coded onto magnetic tapes and fed into the computer, giving it a language memory bank. Once this is done the foreign text is fed to the computer that returns it translated as an English printout or a magnetic tape.

This system already has gone well beyond the purely experimental stage. In one crash program, machine translators were able to disambiguate Army manuals into Vietnamese, averaging about two hours per manual, to accommodate the South Vietnamese takeover of U.S. equipment.

Alcoholism breeds deformities

Alcoholic women who become pregnant may be endangering both the physical and mental health of their unborn children. A study made by doctors at the University of Washington found that chronically alcoholic pregnant women give birth to children with serious birth defects.

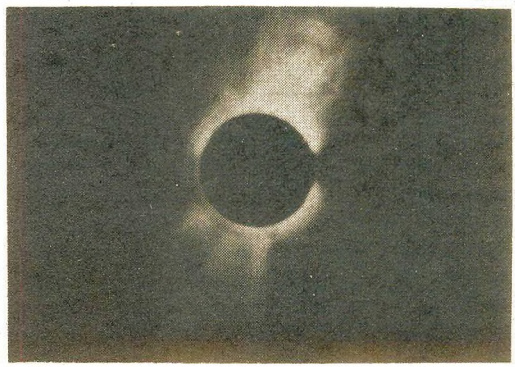
In the medical journal *The Lancet,* Kenneth L. Jones, David W. Smith, Christy N. Ulleland and Ann Pykowicz Streissguth described eight cases of deformed children born to mothers who drank heavily while pregnant.

All the children born had below normal intelligence, weighed less and were 20 percent shorter than the average infant. Most had below average abilities in performing motor tasks and were afflicted with a variety of physical defects such as heart murmurs and deformed or undeveloped limbs and facial features. All the children were permanently retarded in their growth even with hospital care and medical treatment.

The only common factor the researchers found that could explain these deformities was the alcoholism of the mothers. The children were from three racial groups and a variety of socio-economic levels. None were related and none had defective chromosomes.

The researchers have not been able to pinpoint how alcohol causes these defects but Dr. Smith estimates that as many as 20 percent of alcoholic mothers give birth to deformed children. Since there are an estimated one million alcoholic women in the U.S. of child bearing age, the number of children affected is not small and no decline is in sight. ■

NASA



This photo made by the White Light Coronograph aboard Skylab on June 10, 1973, shows a swirling solar eruption about 220 times the diameter of the earth expanding outward into space at a speed of about one million miles per hour. Such eruptions are a result of the intersection between solar material and magnetic fields around the sun. When such eruptions are toward earth, they cause geomagnetic storms and disrupt ionosphere radio transmissions.

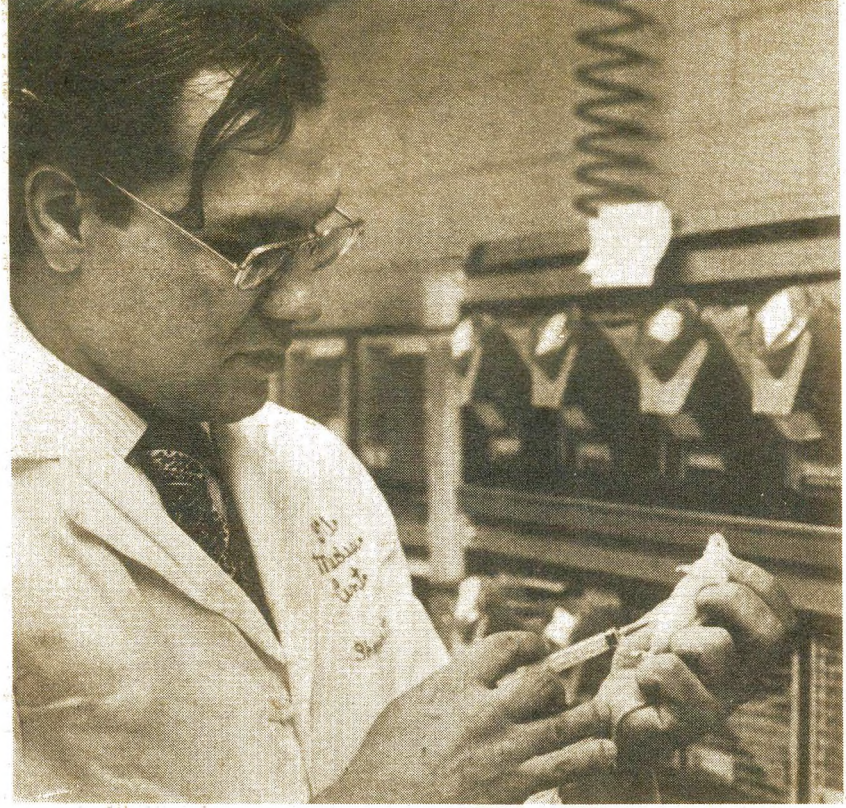


Photo by Ed Lacey Jr.

by Douglas Colligan

IN ITS EXTREMES its effects can be psychologically devastating. Wolves and dogs become hysterically timid creatures, while mice turn into savage, bloodthirsty animals. Humans become paranoid, have schizophrenic reactions from its impact, or sink into deep depression. Scientists give its causes as "stimulus impoverishment" or "decreased somatosensory input" but most people experience it as loneliness.

With science-fiction-like space journeys, like the planned two-year Mars trip, and the isolation that comes with them coming closer to realization, concern over the psychological and physiological effects of loneliness has prompted a number of studies about its effects. Research with both men and animals has shown that long term isolation results in abnormal behavior and creates biochemical havoc in the brain's nerves and some of the body's powerful hormones.

For example, one pioneering study, conducted by Dr. D. O. Hebb, a physiological psychologist at McGill University, used student volunteers exposed to prolonged stretches of monotony for as long as they could stand it. To dull their senses as much as possible the subjects wore translucent visors which let them see light but not patterns, and their hands were encumbered with heavy cotton gloves

The Biology of Loneliness: isolation vs. our brains

Isolation can bring with it drastic personality changes in both men and animals after a long period of time. Now research has disclosed it also disrupts normal hormone secretion, causes changes in the body's nervous system and alters its response to drugs.

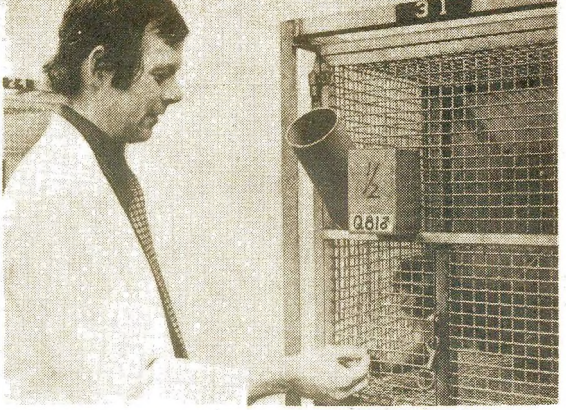
Photos courtesy of Wisconsin Primate Center

and long cardboard cuffs. The only sound in the test area was the drone of air-conditioning equipment and even this was muffled by a U-shaped pillow that the subjects lay down on.

Those that stayed for as long as 24 hours or longer showed childish emotional responses, had hallucinations and delusion peculiar to individuals in states of schizophrenia.

Some military researchers in a long term program called Project Argus studied the effects of long term isolation on individuals and groups of men. According to Dr. Bruce Welch, a psy-

Research with isolated mice by Dr. Francis DeFeudis (opposite) pinpointed changes in the brain's nerve cells while at Wisconsin, researchers used a kind of monkey therapist to rehabilitate isolates.



Wisconsin Primate Center

Dr. McKinney and fellow researchers managed to devise two techniques of reversing what were formerly thought to be irreversible effects of loneliness on his monkey subjects. By a gradual socialization process and by chemotherapy, he found he could rehabilitate isolate monkeys to the point where they could rejoin their peers as normal animals.

chiatrist at Johns Hopkins University and a member of the Maryland Psychiatric Research Center which studies the effects of environment on the brain, the program reached two general conclusions true for any animal, man or mouse.

The first was that the brain craves some kind of stimulation to function normally. "Man is a stimulus seeking creature," Welch explained. "We found that people who maintained an exercise routine in isolation are better able to avoid the motivational loss and debillitating effects of long-term isolation." Just the simple act of exercise, Welch says, stirs the prime receptors in the muscles which pass on these stimuli to the brain.

The second common denominator of loneliness was that isolation *in itself* is not a source of great physiological stress causing wild disruptions in the brain. In fact, Welch points out, the opposite happens. There is a lowering of motivation and the secretion of a number of bodily hormones slows down. Neural transmitters, those chemical substances that excite other nerve or muscle cells, are produced and used more slowly in the body after lengthy isolation. While isolation may be psychologically stressful in restricting intellectual functioning, Welch says it does not cause any physiological stress.

According to work done by Dr. Thomas Myers, a Navy psychologist who worked on Project Argus, the real pressure comes from *restrictive* isolation or confinement. "It's like on the submarine," explained Welch. "A guy may be okay but if you have to live an elbow away forever, it can get on your nerves."

The extra element of restriction, he adds, is what contributes to physiological stress and contributes to a hyperexcitability in many individuals. When an individual in isolation is aroused there is a biochemical chain of events which translates itself into an abnormal reaction.

To find out more about this intensified version of loneliness scientists at the Regional Primate Research Center at Wisconsin University are subjecting rhesus monkeys to different types of isolation and separation.

The Wisconsin team found that after six months the effects of isolation on the monkeys appeared irreversible. The monkeys behaved in psychopathological patterns much in the way autistic children act. When exposed to their socialized peers they showed some aggression toward the crowd but generally remained apart clutching and hugging themselves and rocking back and forth.

This happened under two kinds of isolation, complete and partial. Com-

plete isolation was the removal of all contact, social or visual, with peer monkeys while partial isolation kept a monkey physically separated from his socialized relatives but in full view of them.

Although the Wisconsin scientists first believed this enforced loneliness socially crippled these monkeys permanently, they generally devised ways and methods of rehabilitating them.

The first technique of corrective therapy devised by Dr. William T. McKinney Jr. and his associates is a kind of self-help program among monkeys. The shy, withdrawn isolates are placed in a cage with a younger monkey at the same approximate developmental level. Then, according to McKinney, "you can gradually provide them with experience with animals that are closer and closer in age to them. You can eventually get them to the point where they are social with their own peers." The result he says is a permanently rehabilitated animal.

In an attempt to get directly at the brain of the recluse monkey McKinney is also trying to use chemical leverage, a tranquillizer called chlorapromazine commonly used with human psychotics. After the drug was administered once daily over a twelve week period the monkeys were more relaxed and showed none of the abnormal behavior that they had before.

Chlorapromazine works by blocking the depressant action of serotonin, a neurohormone found in the hypothalamus. The hypothalamus is a structure at the base of the brain that instigates the body's reactions to stress.

While the socializing technique seemed to accomplish a permanent reversal of the effects of isolation, McKinney found the chlorapromazine therapy limited. "The chlorapromazine animals do reasonably well as long as you keep the drug up," he remarked. "When you drop the drug they tend to relapse, but when you start the drug they tend to improve again."

Other experiments McKinney is conducting are aimed at seeing what other brands of loneliness do to the brain and how they make their mark biochemically. In a separation experiment McKinney and fellow researchers watched young monkeys three to five months old after they were separated from their mothers.

"Very much like some human infants when they undergo separation from their mothers, they undergo depressive type reactions," McKinney recalled. "It occurs in two stages. There's an initial stage called a protest stage in which they're very hyperactive, a lot of locomotion, a lot of scampering around the cage in attempts to get back to the mother. They're very upset.

"Then after about 36 or 48 hours," he continued, "they go into stage two which is called the despair stage. They then become very hypoactive. They huddle in a corner, become uninterested in their environment. They're withdrawn."

After examining brain samples of the separated monkeys he found what he described as "a lot of evidence to reflect changes that would produce nervous system activation both peripherally and centrally." What McKinney found were higher levels of enzymes needed to produce the stimulant hormone norepinephrine as well as higher levels of norepinephrine itself. In addition he found increased amounts of serotonin, a neurohormone that in large doses acts as a

sedative and which, according to some scientists, can cause schizophrenic symptoms if present in excessive amounts.

Hormones are not the only substances affected by extended loneliness, however. Dr. Francis V. DeFeudis, a biochemist at Indiana University, was able to pinpoint other changes in the brain.

Using paired littermates of mice he took half and placed them in a mouse community of 20 to 25 individuals and isolated the other half individually for periods of five to ten weeks. The results were no less dramatic than other isolation experiments.

During the mice's isolation DeFeudis noted, "their behavior changes are really like depression. They would resemble depressive withdrawn states in humans. It is only upon re-exposure of them to other animals of the same species that you see this aggressiveness, a very intense, aggressive behavior—fighting, drawing blood."

Looking for biochemical clues he injected radioactive tagged glucose into brains of a loner mouse and its socialized littermate. The isolates' brains he found absorbed much less of this form of sugar necessary for generating energy in the brain's biochemical activities. Other comparative examinations revealed that nerve endings of the isolates could not retain chemical inhibitors as well as the socialized mice. "This might be an explanation for the aggressiveness," DeFeudis explained. "We think they actually possess a lesser number of inhibitory nerve endings in their brains which also might tend to explain the increased aggressiveness."

This low count of inhibitory nerve endings, DeFeudis says, is directly linked to the deadening experience of isolation. "Psychologically the isolated animals are cut off from much of their sensory input, and if you reduce these inputs that are normal to an animal, there is a tendency for degenerative changes to occur in the brain."

Suspecting that these drastic changes on a microscopic level might also mean a changed reaction to drugs, DeFeudis selected two mood changing drugs to try on his mice. His choices were dexedrine, an addictive stimulant, and lithium, "the treatment of choice today for manic-depressive psychosis."

Testing them on both types of mice he discovered that "social isolation of the mice changed their nerve endings so that these psychoactive agents were retained more by their nerve endings." And since their brains and nerve endings absorbed more of the drugs, he reasoned, the drugs' impact would be greater with the isolates.

Moving up in the animal kingdom from mice to men does not change things very much biochemically according to DeFeudis and what he discovered about mice can apply to men as well. "It may not be especially flattering, but the biochemistry of mice and men is very similar," he remarked.

For example, what he has uncovered about the changed response of the brain and nerve endings can give some insights into drug addiction. "We usually associate a greater potential for addiction in humans that are isolated socially," he observed. Addicts lay the groundwork for their addiction by creating their own isolation which causes the brain to become more receptive toward an addictive drug.

Research in isolation has another relevance to human condition, impri-

As an effective method of discipline, solitary confinement does a prisoner more harm than good.

sonment. DeFeudis believes that penal tradition such as solitary confinement aggravate more problems than it solves. Citing the aggressive behavior of isolated mice upon re-exposure to their peers, and studies with humans that showed aggressiveness following isolation, DeFeudis commented, "this is my main objection to using measures of solitary confinement for improving prisoners. The other is that solitary confinement, if it works like it does in mice, would increase the aggressiveness of prisoners upon their release to society, rather than decrease it."

Bruce Welch is not as ready to draw analogies between animal research and human behavior and points out some differences in working with isolated animals. As far as drug response goes he says, "animals respond differently to amphetamines when you change the environment whatever kind of change it is."

Using animals as models for human behavior also has its drawbacks because of the inconsistent results that come out of experiments with different animals. Aggressiveness is not a typical reaction of *all* animals used in loneliness experimentation. "It [aggression] occurs in some animals," he said. But you generally find it in mice but not in rats, monkeys or dogs." The males in a certain strain of rabbits, he added, atypically became aggressive after isolation while experiments with isolated wolves produced individuals virtually afraid of their shadows.

"The common element is this," he explained: "all species do become more irritable and hyperexcitable and it just happens in some species the increase in irritability and excitability, for reasons we really haven't defined, is associated with an increase in aggressiveness."

One area in which Welch does agree with DeFeudis is on the topic of solitary confinement. "One thing I've emphasized to the heads of the penal systems," Welch states, "is that from all we know from both lower animals and primates, putting people in isolation as punishment for antisocial behavior is likely to produce the opposite results of what you want."

But all this probing into the biochemical effects and psychological aftermath of loneliness stands to benefit more than a select few astronauts, submarine crew members or prison inmates. "A lot of people in our society live alone in spite of the fact that they live in large numbers in a given area of land," Welch observed. "To the extent isolation makes individuals hyperexcitable they are prone to inability to act socially, to make bonds socially and sustain them. This tends to set up a vicious cycle in which they are alone, become hyporeactive, become more rejected and become more alone. It has a feedback effect—loneliness making loneliness."

With a few more insights into the biomechanisms of loneliness maybe someday this cycle can be broken. ■

For further reading

PSYCHIOBIOLOGY: THE BIOLOGICAL BASES OF BEHAVIOR. *Readings from Scientific American W. H. Freeman and Company. San Francisco. 1967. 382 pp. $10.00.*

Illustration by Ellen Williams

Senility is reversible

Hyperbaric chambers, anti-senility pills and special therapy are all new weapons in the attack on senility. But some scientists say that senility is just a cruel invention of society and happens only to people who "think old."

by Douglas S. Looney

FORGET everything you ever thought you knew about senility, that terrible trick of the mind that makes us fanciful and foolish when we grow old.

Nature, it seems, may have precious little to do with our aging brains' going into eclipse. In short, there is persuasive evidence that senility may be avoidable. And often reversible.

The answer lies not so much in miracle drugs, although such a breakthrough (as the Salk vaccine for polio) may someday help; not so much in treatment, although several methods appear to be helping. More than anything, it lies in establishing your own strong psychological defenses against the malady many thought for years was inseparable from old age.

"Senility is an invention of modern Western society," complains the State Communities Aid Association of New York City and Buffalo. "It is one of

the most damaging self-fulfilling prophecies ever devised."

Senility—as most of us fear it, doctors define it, and the American Psychiatric Association sets it forth—involves one or more of a lot of shortcomings as we grow older: impairment of orientation, memory, intellectual function (including comprehension and calculation), and judgment. Its extent is influenced, too, by one's personality, emotional stability, environment, and expectations. Senility is a mental disorder that damages the brain and often triggers bizarre actions, dismaying family and friends. Dictionaries equate senility with old age, but growing numbers of experts say the two are not inexorably linked.

Whatever its definition, senility isn't a concern solely of old people. It's also a concern for middle-aged people who want to avoid its grip, and—especially—for people of all ages as they watch their parents, relatives, or friends become senile.

Dr. Mort Ward, medical director of the Philadelphia Geriatric Center, leaders in research into senility, suggests, "It's not whether you are senile but whether others think you are."

All of which ties into one of the keys to senility: anxiety. One in six people over 65 is senile; a lot more fear they are.

"I lose my eyeglasses five times a day," says Dr. James Folsom of the Veterans Administration (VA) in Washington, D.C., "and nobody says I'm senile. But if somebody old does this, everyone gets hysterical." However, as you can't tell a child there is no monster under the bed, you can't brush off a person's concern about senility.

With some it's a profound fear. Dr. Ewalt Busse, chairman of the Council on Aging and Human Development at Duke University, says, "People are more fearful of being incapacitated than dead." A Michigan State University researcher adds: "Senility is the result of a fear of impending death. Thus senility becomes a psychopathological defense against death."

Here at the geriatric center, Bernard Liebowitz, executive vice president, says, "It's the frightening thing of not having control." And another staffer shakes his head: "The trouble is you live with senility, you don't die."

"Don't anybody hold my hand," insists Mrs. Sarah Seidenberg, a resident here. "I can walk fine." Asked where she was born, she responds, "In bed," and chuckles. She throws up her hands at the suggestion of senility, saying, "God forbid." She works two hours a day. She often goes on excursions to Atlantic City, N.J., for fun and to New York for shopping "because Philadelphia is too slow."

She's also 103 years old.

Keeping your mind in shape is of prime importance in avoiding senility, experts say. The brain must be used to ward off "flabbiness" caused by lack of mental gymnastics. And senility, those who know contend, isn't natural. It's a disease.

Col. Harland Sanders, the 83-year-old Kentucky Fried Chicken man, was reached in a Los Angeles motel in the midst of a 30,000-mile, five-week trip around the world. "You'll rust out quicker than you'll wear out," he says, adding, "I'll just go on about my business doing the best I can until the Grim Reaper calls me." And senility, Colonel? "I'm not going to get senile, so what do I have to worry about?"

Traditionally the main cause of senility has been thought to be arteriosclerosis, hardening of the arteries.

This heavily hereditary ailment affects nearly everyone to some degree, clogging the blood vessels with calcium and cholesterol. But autopsies fail to show any constant relation between arteriosclerosis and senility; some people have excessive artery hardening (allowing less oxygen and blood to reach the brain and thus supposedly impairing function) but have functioned normally throughout life. Others get senile without significant arteriosclerosis.

And if senility does destroy gray matter (doctors are inclined to think it does), this is considered of relatively minor import in many cases, simply because most of us fail to use a major part of our brains anyway. Far more important is which cells are destroyed. Says Dr. Ward, "I think your best bet is to hope you lose only unimportant ones."

Brain disease is another factor in senility. There is thought that disease may come about because we all have some sort of latent virus that sometimes is set off, sometimes not.

Col. Sanders: "I'm not going to get senile so what do I have to worry about?"

Wide World

Other possible causes of senility include exposure to radiation, early nutritional shortcomings, isolation, bereavement and alcoholism.

Mrs. Muriel Oberleder, assistant professor of psychiatry at Albert Einstein College of Medicine in New York City, says, "Frankly, I believe that people bring senility upon themselves." The VA's Folsom agrees: "I think some people have been born senile. They've never had an original thought. They don't grab life; they let life grab them."

Researchers still are as uncertain about senility's cause as they are about its cure. Yet nearly all the authorities consider senility far from hopeless. Here are techniques—keeping in mind that the brain probably starts deteriorating between ages 20 and 30—that experts think can help you ward off senility:

Be active. "I think it's far better," says Folsom, "for anybody to slip on ice and break a hip than to slip on a rug and break a hip. Too often we make sure people are seated in a comfortable chair rather than being up exercising."

Eat properly. The young too often eat on the run; the old too often settle for a meal out of a can.

Be interested. An old Alabama farmer moved to town but he still returns to the farm daily to check the cows and chickens, explaining: "They need me. And I need them." Mrs. Ernest J. Wakefield, 82, Kensington, Md., gets up at 5:30 a.m. daily and reads current literature for two to three hours. "I sure would be mad if somebody called me senile."

Be smart. Arthur Waldman, consultant at the geriatric center, says senil-

"Senility is an invention of modern Western society; nothing more than a damaging, selfless prophecy."

ity appears to come more often to the lower end of the intellectual ladder than the top.

Control stress. This byproduct of modern living seems to do our brains no good.

Vitamins may help. Ascorbic acid (vitamin C) is popular; B-12 shots are given regularly. Placebos might do as well, but if you think it helps, that's much of the battle.

Get adequate sleep. But older people should avoid constant dozing, which in turn prevents sleeping at night, which gives them time to worry about lots of things. Like senility.

Give yourself pep talks. Folsom suggests a daily dose of: "I'm not going to give up by pieces my interests. I will pick up on new concepts and not live in the past." Mrs. Margie T. Wild of Portland, Ore., a cousin of Folsom, says she discovered she was getting senile. How did she avoid it? "I refused to let it happen to me."

Learn new skills. If you have led an intellectual life, take up bricklaying. If you're a bricklayer, try reading.

Think in terms of second and third careers. Colonel Sanders started what he calls "this chicken thing" when he was 66.

Don't get fat.

Do things for others. The geriatric center's Dr. Ward says 25 per cent of people over 65 live alone; that leaves too much time for self-pity. Look outward.

Don't fret about memory lapses. "By the time you are in your 60s," says Busse of Duke, "you know a lot of people, so of course you forget some of their names." Mixing up names of children is natural at age 70 as it is at age 40, when we may be experiencing our first, minor memory losses. Network television commentator Chris Schenkel forgot his name while reporting the Mexico City Olympics in 1968. Nobody thought him senile.

Don't think you are becoming stupid. You're not. Research shows that you will hold your IQ well as the years go by.

Don't give up things in the name of, "I'm getting old and forgetful." If you play tennis today, play tomorrow; if you go to church this Sunday, go next Sunday (even if it's cold); if you went to concerts last spring, go this spring. Giving up anything is a huge step toward senility.

Inspire yourself. Look at Mrs. Elmer Broders, 77, of Kansas City, who ice skates daily. Or look to history's greats who have seemed to avoid senility; Supreme Court Justices, Churchill, Moses, Segovia, Cassals, Toscanini.

Curb your anxieties. "The climax of middle-age fears," says Einstein College's Mrs. Oberleder, "is senility."

How to treat old people

But if many of us, young and old, can take these strides to ward off the octopus of senility, how do we cope with friends and relatives who seem senile? Some of us respond badly. Why? "Many people just can't handle anything that's not pretty," says the geriatric center's Liebowitz. "And senility isn't pretty."

Mrs. Elaine Brody, director of social work here, emphasizes that therapy for the senile, no matter how

intensive, must be continued. If not, the gains are quickly eroded.

Ward, her colleague, says the trick is "simply to give them a little bit of interest in still being alive." In her no-nonsense book, *How To Help Older People,* Julietta K. Arthur details the senile's needs: "Somewhere to live, something to do, and someone to care."

Avoid endorsing senile behavior. Folsom explains: "We reward them for being forgetful. We say, 'Oh, mother has lost her glasses. Let's all help look.' Then mother realizes that's the only way she can draw attention to herself."

Give older people aids. Mrs. Wakefield uses a ruler with a magnifying glass. That makes abundant sense—especially if the alternative is not to read at all. Listen to the older people, share ideas, and try to be sympathetic to their concerns. And as two researchers at Louisiana State University wrote recently, "It's important not to take away all of life's pleasures in the interest of prolonging life."

Alcohol for the senile? Says one prominent authority, "A little sherry sure beats the hell out of Geritol." Avoid a smothering kind of love. Just because an older person forgets to record a check on the stub doesn't mean he's unable from now on to write checks. Because he forgets to tie his shoes, it doesn't mean that he must forever wear slippers.

'Reality orientation' treatment

A prime way to cope with senile behavior (doctors often come up with the senile diagnosis when they can't figure out what else could be wrong) is through a common-sense concept called "reality orientation."

This was developed by the VA's Folsom. Trimmed to the basics, the program requires repeated emphasis on now: "What day is today?" "It's Monday morning. That means it's time to go to therapy." "It's noon, so it's time for lunch." "What's your name?" Says Dr. Folsom, "Our biggest problem is convincing family members it's not hopeless."

And it's not. Examples abound of people diagnosed as senile who then recover. A cotton broker in Mississippi, for example, became increasingly irritable, threw his wife out of their home, and locked the door. After intensive reality orientation under Folsom, he returned to a normal life. His wife later wrote, "Thank you for giving me my husband back."

Following surgery a person often will awake with "instant senility." This can be erased quite soon, insists Folsom, by patience, perserverance, and by not letting the patient get away with senile behavior, which becomes fairly easy to detect. At this point, a little psychology goes a long way.

Dr. Carl Eisdorfer, chairman of the department of psychiatry at the University of Washington, explains: "To the layman, names, dates, and places may be small, but the alternative is nothing. It's life in front of a television set where the vertical hold is always shot."

There is evidence that specific treatment may help. Most exciting are the hyperbaric chambers, where oxygen at above-atmospheric pressure permeates the brain much better than at ordinary pressure. The leader in the field is Eleanor Jacobs of the VA hospital in Buffalo. But she claims no miracles. She admits that some results have been good with arteriosclerosis cases, but results are poor where there is brain disease.

"The climax of middle-age fears," says one New York City psychiatrist, "is senility."

Association with Naziism

Miss Jacobs says hyberbaric work is going on at a half-dozen centers, including Miami, Duke, New York University, Milwaukee, and in Southern California. "I think the real hope for hyperbarics," she says, "is for preventive treatment. But I don't believe this is the final answer for senility."

One of the major problems is that the treatment (at Buffalo, two 90-minute sessions a day for 15 days) doesn't seem to have much lasting effect. While there is no discomfort, Alvin Goldfarb of New York City reports that he found many Jewish patients recoiled at the treatment, apparently associating the chambers with the Nazi gas chambers.

"When discussing the hyperbarics," says Miss Jacobs, "I think it's good to be conservatively and scientifically skeptical. I don't believe in this fountain-of-youth junk." Colonel Sanders has been in the hyperbarics and, while not an enthusiastic fan, he concludes, "I figure it helps me." He plans to go back.

An Antisenility Pill?

One authority says, "Off the record, I'd think they're probably worthless. On the record, I would say there is evidence on both sides, but it needs a whole lot more research." Waldman of the geriatric center suggests, "I don't think they're any better than copper bracelets. Of course, copper bracelets seem to do pretty well for some people."

Pharmaceutical companies are scrambling to develop an effective antisenility pill. Ward cautions that older people can tolerate perhaps only one-third to one-half the medicine dosage of younger people, and he notes, "It's very easy to produce a row of zombies."

Dr. Nathan Kline, director of research at the Rockland (N.Y.) State Hospital, is testing a Romanian-produced drug, a derivative of procaine. "So far we haven't proved it doesn't work," he says. Tests are proceeding to see if it has any effect as an antidepressant. If it does, its effects on senility may be tested. All we have now are extravagant claims from abroad mainly that the drug inhibits aging.

There has been work on thinning blood in order for it to pass through troubled arteries, but hemorrhaging presents problems. Expanding arteries has a chance, although Ken Pommerenck of New York's State Communities Aid group wonders about the virtues of "expanding brittle pipes." Marjorie Fisk Lowenthal of the Langley Porter Institute in San Francisco says, "We're thrashing around like we did with polio."

Busse of Duke thinks that we will have medical cures for senility within a decade. A skeptic here says, "Do him a favor and don't quote him on that." But Mrs. Oberleder inclines to agree with Busse.

Many experts think a partial answer will be drugs because, as Waldman says, "Any problem science is willing to look at can be solved." But the rest of the answer, perhaps the biggest part of the answer, involves active and vibrant living and refusing to check your brain at the doorstep when you turn 65. ■

Night smokers face greater cancer risk than day smokers

by Arthur J. Snider

MEN WHO GET UP in the middle of the night to smoke a cigaret may be more prone to lung cancer than average cigaret users even though they may smoke fewer cigarets per day, according to a study at the University of Virginia Medical School at Charlottesville. The study also found that nighttime smoking brings on cancer at an earlier age and that night smokers differ greatly in demeanor from their day counterparts.

Dr. D. W. Abse and Dr. W. D. Buxton of the department of psychiatry speculated that lung tissue may be more vulnerable at night. They cited experiments with nicotine in which a dose given to rats at one time during a 24-hour period was lethal in eight percent of cases whereas the same dose administered at a different time was lethal for as many as 75 percent of the animals.

The investigators compared two groups of chest patients. All night smokers (those who actually awoke for a smoke) developed lung cancer. Of those who did not smoke at night, only half got cancer. The nighttime smokers were young (average 56) and used 1.3 packs a day on the average as compared with 2.8 for non-night-smokers (average age 60).

This suggests that night smoking tends to lower the age at which the patient develops cancer, say experts.

Illustrations by Ellen Williams

What motivates the night-time smoking? According to the psychiatrists: "Our feeling is that nighttime smokers display to a somewhat greater magnitude the kind of personality that we felt is characteristic of the lung cancer group," Dr. Buxton said. "They are more controlled in their emotions. They have greater stability in their married life and fewer psychosomatic complaints."

In many cases, the night smokers were vocationally stable workers who had reached a plateau of achievement and had no further advancement or recognition to look forward to. They responded to neither events nor other people in an emotional way. They could not express feelings they carried with them. "The kind of impression they made was suggestive of the American Gothic," said one doctor.

Nighttime smoking then, may be a way of compensating for missing emotional satisfactions.

Cows tricked into producing less fatty milk

To prevent heart attacks, a government research team is using a recently developed Australian technique to get cows to produce milk with a lower

content of harmful saturated fat.

Saturated fat is associated with hardening of the arteries and is often said by heart experts to cause coronary heart attacks. These physicians have recommended substituting unsaturated fats, found in fish and cooking oils, for the saturated fats found mainly in butter, cheese, cream, whole milk, egg yolk, pork and beef.

But the public has been reluctant to cut down on these foods, so a research team headed by biochemist Joel Bitman of the U.S. Department of Agriculture in Beltsville, Md., decided to increase the content of unsaturated fats in these foods. They started with milk.

They found that while cows eat grain, hay and grass, all containing large amounts of unsaturated fatty acids, their milk and meat comes out as saturated fat. The reason is that bacteria metabolize the unsaturated fats to the saturated type in the rumen where the cow chews its cud.

Australian scientists have been able to trick the rumen and get the unsaturated fat down into the intestines by enclosing unsaturated vegetable oil droplets in a protein coat and then spraying the coat with formaldehyde. This protects the oil from the bacteria in the rumen. The unsaturated fat is absorbed in the intestines and appears in the milk and meat.

Adding the coated oil drops to the cow's feed, U.S. agriculture scientists have produced milk with an unsaturated fat content of 35 percent rather than the usual three percent. The research team has also produced beef with 18 percent more unsaturated fats and veal with 14 percent more.

Sickle cell athletes play hard

A survey shows that almost seven percent of black athletes in the National Football League have the sickle cell trait in their blood but their genetic condition is no barrier to playing a rigorous sport. The survey covered 26 of the 29 teams in the NFL.

Samples were drawn from 579 black players at training camps and sent for analysis to Dr. John R. Murphy of Case Western Reserve University. The sickle cell trait was found in 39 players.

Sickle cell trait does not mean the athletes have anemia but rather that they are capable of transmitting the potential for the disease to their offspring. However, the sickle cell trait is not entirely harmless. Ruptures of the spleen have occurred in some in-

dividuals after exposure to high altitude in non-pressurized planes. Kidney damage has occurred occasionally in others.

An editorial in the *Journal of the American Medical Association* says the trait is no drawback to competition. "It is of interest to note that one of the teams in the NFL (Denver Broncos) plays half of its games at an altitude of more than 5000 feet," Dr. Murphy pointed out. There has been no report by any team physician that playing in Denver has harmed any of their black players. However, he added, it should be noted that all NFL players are reasonably well-conditioned athletes.

The incidence in players is a bit lower than the eight to ten percent prevalence found in the general population of two million blacks in the United States. Dr. Paul Heller, hematologist at the West Side Veterans Administration Hospital, Chicago, says the survey demonstrates that the "much-publicized fatal influence of overexertion" in the sickle cell trait does not have solid data to support it.

Colds can be caught by hand

A new study shows you can give yourself a cold by unwittingly picking up another's germs from an object he has touched and transmitting them to your nose or eyes through your contaminated fingers. The person who gives you the cold need not be in the room at the same time. In fact, he may not have been there for at least six hours. The germs, surprisingly, have the capacity to survive in a dried-out state on the surface of the kitchen counter, a water faucet or an eating utensil.

Dr. J. Owen Hendley, a pediatrician at the University of Virginia Medical School, has demonstrated the "self-inoculation" mode of transmission in studying employes of an insurance company and members of their families. The germs transmitted were rhinoviruses, which are believed responsible for a third or more of common colds in adults. Rhinovirus infections are commonly brought home from school by children and given to adults in the family.

In his experiment, Dr. Hendley tried first to promote a cold by what has always been thought to be the main method of transmission—coughing and sneezing germs from one person to another. But he found colds were hard to come by via the aerial route. "The hands turned out to be the key in most colds, Dr. Hendley said. "An individual will touch a faucet in the bathroom, for example, and deposit viruses on it. The next member of the family will use the faucet a few minutes later and pick up the virus."

Most of the subjects who came down with colds brought their contaminated fingers into contact with the lining of their nostrils or to the covering membrane (conjunctiva) of their eyes through rubbing.

It has been widely believed that a rhinovirus perished once it lost its fluid nutrient, but Dr. Hendley's report in the *New England Journal of Medicine* showed that it can live for a long period in a dried state on hard surfaces and on the skin. "We were astonished by the survival time," he said. "We had viruses that survived overnight on plastic surfaces."

What are the implications of the self-inoculation findings? "Simply this," replied the pediatrician: "If you wash your hands before you pick your nose or rub your eyes, you are un-

likely to get a cold. My wife has assured me that it won't work for the mother of pre-school children. There is no way of running children to the sink every half-hour to make them wash their hands."

One must be careful in covering the nose and mouth with a handkerchief or soft tissue in coughing or sneezing not to let the moist mucus get on the hands, Dr. Hendley cautioned. Obviously, coughing into the open palm is a good way to transmit viruses.

Dr. Hendley's findings now explain how colds probably were transmitted in the day when school kids drank from the same cup or drinking glass. "The thought had been that virus was transmitted by each mouth contacting the glass," he pointed out, "but the likelihood is the virus was picked up by the succession of hands holding the glass."

Little League elbow blamed on parents

Little League shoulder and Little League elbow are ailments that come from youngsters pitching too long and too hard. Yet rules to prevent excessive wear on pitching arms by limiting innings and ruling out curve balls are constantly flouted. Many a father can see his son reaching the major leagues, so he encourages extra hours of throwing practice at home.

"As long as adults control and dominate these organized baseball programs for adolescents, it seems unlikely that any proposed control measures will solve the problem," says Dr. Allan J. Ryan, editor-in-chief of *The Physician and Sports Medicine* magazine.

Dr. Ryan advocates a mechanical pitcher for Little League games to serve for both teams. He notes that it has been used by a little League in Phoenix since 1971. Batting has improved, more runs have been scored and sore arms have been virtually eliminated.

Computer helps overdose victims

A computer can determine in less than two hours which of several hundred drugs a drug-unconscious patient may have swallowed. Massachusetts Institute of Technology has developed a system in which a chemical separating device known as a gas chromatograph is attached to an analytical instrument called a mass spectrometer. This, in turn, is linked to a computer programmed to record and sift through the analytical data. The computer has been programmed to identify any of more than 400 drugs or drug break-down products and contaminants.

"Whenever area physicians encounter a comatose patient whom they suspect has taken a drug overdose, they telephone our laboratory in Cambridge or call one of our chemists at home during non-working hours," says Dr. Klaus Biemann, professor of chemistry. "We get an average of five to ten calls a week from such institutions as the Massachusetts General Hospital, the Boston Children's Medical Center and the Boston poison control center. The physician then sends samples of the patient's blood, urine, gastric juices or other body fluids to MIT by messenger. The chemist extracts the organic constituents of the sample with a suitable solvent and injects the extract into the gas chromatograph."

The individual substances in the extract are separated and enter the mass spectrometer which breaks up the

molecules and sorts them according to how they behave in a magnetic field. The array of fragments represents a molecular fingerprint which is unique for each substance.

Finally the computer scans the fingerprints and searches its memory for a match. It examines 400 fingerprints for each sample, identifies each substance, prints out its name, then lists them in order of concentration.

The system has reduced analyses from two days to less than two hours.

Your tonsils are your friend

Medicine seems to have come the full circle in removal of tonsils. Not too many years ago, 30 to 40 percent of all operations involved removal of tonsils and adenoids. It was the most common surgical procedure because it was believed that they were responsible for upper respiratory infections, sore throats, rheumatic fever and other problems. But now it has been found these fears are unfounded.

Dr. Simon Ball, clinical professor of otolargyngology at Hahnemann Medical College and Hospital, Philadelphia, says it is now becoming apparent that tonsils and adenoids play a role in protecting against disease by serving as a protective barrier and helping produce immune bodies. Thus, by lowering his immunity, removing a child's tonsils may eventually prove harmful to him, Dr. Ball says in the journal *Consultant*.

Does this mean tonsils or adenoids should never be removed? No, indeed not, says Dr. Ball. They should be removed if more than three attacks of tonsil inflammation occur during the year, if tonsils and adenoids become so enlarged they cause extreme snoring or difficulty in breathing or swallowing, and if they are involved in hearing loss.

It's illegal to die

A growing number of individuals do not want extraordinary measures taken to prolong their lives if they are incapacitated or near death. But there is little chance they will get their way. Too many factors work against it, says Dr. D. B. Hiscoe of Michigan State University. Even if an individual made a will requiring the plug to be pulled, says the doctor, the document has no validity in the eyes of the law.

Another factor is family influence. If the patient is unconscious or disoriented, the family speaks for him. "These decisions aren't based on what is best for the patient," says Dr. Hiscoe.

The family decision is usually based on such psychological factors as guilt feelings about past behavior toward the patient, a fear of loneliness, a fear of death in general, and shock, especially after an acute accident. "Sometimes it takes several weeks of heavy expense and pain to convince them that the initial pessimistic predictions must be accepted."

Because of family and legal influences, a doctor usually chooses to follow the conservative route and do everything in one's power to prolong life. Dr. Hiscoe believes, however, that there is increasing social acceptability of passive euthanasia, which implies nothing be done to hasten death but that certain measures that might postpone death are not taken. "In these cases we are not really deciding who will die—everyone dies," said Dr. Hiscoe. "We are really deciding who will be made to live." ■

SCIENCE DIGEST mind bender

Editor's Note: *Finding the ages of our friends in last month's mind-bender was an easy task. But for those of you who couldn't quite get it, here's your explanation: Consider B's remark. If it is true, it is false (he cannot both be 81 and making a true statement). It's false and therefore B is under 50 or 64. As a result, C's remark is false, and C must be under 50 or 64 or 81. D's second statement is true, therefore D is over 50 or 27 and D's first statement is true. This means A is 57 and is telling the truth about E who is 27. B is older than A but B is under 50 or 64 and A is 57, so B must be 64. E's second statement is true. D is 27 or over 50; C is 64, 81 or under 50, and D is 30 years younger than C. Therefore D is 51 and C is 81. Ages are: A 57; B 64; C 81; D 51; E 27.*

Now try this one

ANDY, BOB, CHUCK, DAVE and ERNIE are making predictions about the order in which they will be placed for their coming efficiency test.

They speak as follows:

ANDY: Bob will be two places higher than Chuck.

BOB: I will be third.

CHUCK: Dave will be first.

DAVE: Bob will be second

ERNIE: Chuck will be three places lower than Andy.

It was interesting to see, after the test was over, that of these predictions only one was right, and that was made by the person who was first. What were their places in the test?

Answer to this month's mind-bender will be in the January issue.

Scientists find two brains in one

A PSYCHOLOGIST at the *California Institute of Technology* has found one more complication in the already complex human brain. Experiments on patients with "split brains" showed that the two halves of the brain are not only physically distinct but are also two entirely different brains in their functions.

Professor of psychobiology Dr. Roger Sperry and fellow researchers made this discovery in tests with subjects who for medical reasons had the *corpus callosum,* a bundle of nerve fibers connecting the two halves of the brain, severed. Since prior research determined this nerve bundle was a communications and information link between the two halves, the two halves could be studied functioning separately.

The first thing that was apparent was that each half of a separated brain works independently of the other. One dramatic example of this was one patient who found his left hand, controlled by his right brain hemisphere, attacking his wife while he tried to restrain it with his left-hemisphere controlled right hand.

In experiments with 18 such patients, Sperry found that the left hemisphere, tied into the right side of the body, is not only the seat of language and speech but it also appears to be where the analytical abilities of the mind originate. He also found that the right side of the brain, which controls

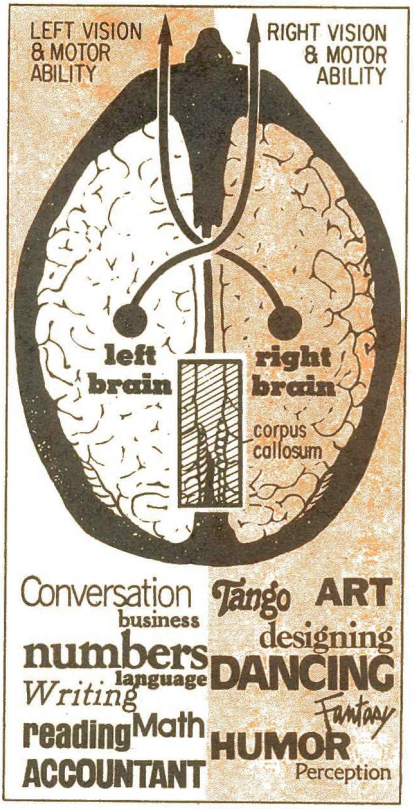


Illustration by Tom Minker

the left side of the body, apparently is where an individual's artistic and more intuitive talents rest. Split brain patients found drawing easier with the left hand than with the right and in one test a subject was able to recognize an unseen object by touch but was unable to describe it verbally.

In other experiments one patient was able to read only that side of a page of print seen with his right eye and could only artistically reproduce that part of an elaborate drawing of a cross seen with his left eye.

In testing this division of brain

functions in normal people as well, Drs. David Galin and Robert Ornstein of the Langley Porter Neuropsychiatric Institute in San Francisco measured brain waves in patients engaged in left or right hemisphere activity.

What they found was that during a letter writing exercise the language-oriented left hemisphere was highly active while the artistic right side was idle. In another test involving the arrangement of colored blocks into some kind of pattern, the reverse was true.

Having broken the code of the brain's abilities, the next challenge for these researchers will be that shadowy right hemisphere which holds its secrets beyond the reach of human language.

Plastic skin saves face

Researchers at the *University of Alabama* have adapted a material used in children's toys for more serious purposes.

They found the plastic polyvinylchloride (PVC) to be one of the best cosmetic substitutes for skin. PVC can be used with a prosthetic device to correct a birth defect or the surgical loss of an ear, nose, eyesocket or any portion of the face and neck region.

Members of the department of prosthodontics use a plaster mold of the facial area to construct a clay model of the prosthetic device. A metal mold cast from the clay model is used to make the actual device. Once the device is finished it is fitted to the patient with a two-sided surgical tape which allows the device to be removed for cleaning and maintenance.

To add to a lifelike appearance, the University of Alabama researchers can not only color match PVC to a patient's skin but they even use fine red and blue nylon fibers in it to simulate the minute capillaries and veins found beneath the skin's surface.

In some cases they have managed to reconstruct an entire side of a person's face using this technique with the result that the prosthesis is almost completely undetectable.

The potential for the uses of PVC is just now being recognized. It can be mixed in a liquid state, can be formed into almost any desired shape and is completely non-toxic.

"The patient may have a disfigurement that discourages normal social and business activities," explained Dr. Dwight J. Castleberry, director of the university's Regional Maxillofacial Prosthetics Center, "and when we can correct that defect cosmetically, the patient benefits psychologically and physically."

Fish farm has bumper crop

When Lake Erie became too polluted to support perch and walleye fish in any significant number, researchers at the *University of Wisconsin* decided to grow their own.

And the results have been spectacular. Feeding their fish crop high-protein pellets made from herring meal, soybean flour and vitamins, the research team headed by Harold Galbert and David Stuber produced giant specimens.

After eight months the fish hit weight levels that were up to ten times greater than those that grow in the wild. In addition, they had a much lower mortality rate than perch and walleye that grow in lakes and streams

and did not have the fishy flavor peculiar to farm-grown fish.

Encouraged by their success, the team plans to expand their project into a full scale hatchery producing the two species for fish markets.

White cells forget VD

A kind of amnesia in white blood cells is responsible in part for the body's susceptibility to reinfection by gonorrhea.

Dr. Murray M. Streitfeld, associate professor of microbiology, at the *University of Miami,* says that while the lymphocytes, or white cells of the blood, usually remember previous bacterial invasions and stimulate antibodies to fight them, they seem to forget in the case of gonorrhea.

He arrived at his findings after experiments with infected and non-infected groups of women. Gonococcal antigens were injected into women who had gonorrhea and into those who did not have it. Blood samples were taken immediately after treatment, then three weeks later, and, again five weeks later.

As a result he found the lymphocytes in the infected women responded to the antigen and began fighting the gonococci. In the noninfected women little or no response was found.

After five weeks when the infected group had recovered from gonorrhea, the antigen test was repeated. Dr. Streitfeld found that the white blood cells in what was formerly the infected group had "forgotten" all about the gonococcal infection and showed the same lack of response as the noninfected group.

Spotting solar flareups

Solar flares can cause anything from a global electrical breakdown to a lethal wave of radiation. Now Ray

An extensive drug addiction study is being conducted at Xavier Unversity. Below, a researcher administers methadone to an albino rat for eventual observation of withdrawal symptoms. Goal is to find proper compounds which will block withdrawal syndrome.

NIH

N. Moses, an astronomer at *Ohio State University,* says he has a clue for making more accurate long-range solar flare predictions.

During the most recent dramatic surge of solar activity, in August of

Ohio State

Astronomer Ray Moses points out an "arch filament system" on a superimposed photo of the sun. He believes these systems are the key to formations of solar flares. His forecasts may provide an early warning system for flares which disrupt communications.

last year, 12 days of solar eruptions caused a series of electrical breakdowns. Transformers failed or exploded, high frequency radio circuits went dead and magnetic storms caused by the flares tripped high voltage circuit breakers on telephone lines.

One way to predict these outbursts and give utilities companies time to prepare, says Moses, would be to keep a lookout for an "arch filament system" developing on the sun. This is a movement pattern of lines of force, or "flux ropes" similar to the lines that curve about the poles of a bar magnet.

These flux ropes group around pairs of sunspots and move in a definite sequence within the layers of the sun's surface. Once these magnetic lines, or flux ropes, have completed a certain sequence of movement, a solar flare is imminent. By watching the development of this sequence, Moses says, it is possible to make a prediction when the next solar flare will occur.

This ability to predict the flares is especially important to future astronauts. During the August, 1972, eruption, for example, a wave of radiation ten times as intense as a lethal dosage washed over the earth. To an individual on earth there was little danger because the atmosphere shielded him; but to a man in space the effects would have been deadly because the astronaut's spacecraft and suit would have been insufficient protection.

No noise from Neanderthals

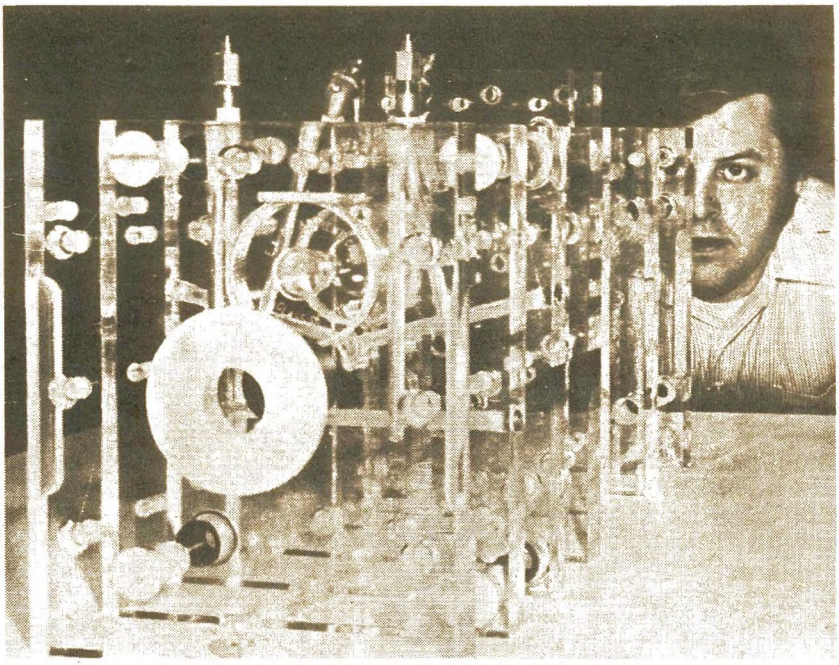
Neanderthal man, who lived in Europe between 35,000 and 100,000 years ago, was apparently the strong, silent type.

This was the conclusion of Philip Lieberman of the *University of Connecticut* after a comparative study of the talking apparatus of a Neanderthal, modern human, a newborn baby and a chimpanzee.

Silicon rubber casts were made of the air passages, nasal tracks and voice boxes of each specimen. A model of the Neanderthal's speech apparatus was made based on the fossil skulls available. By bouncing light through the simulated voice boxes Lieberman determined possible sound frequencies and duplicated possible sounds.

The result of the light tests indicated to Lieberman that while the chimpanzee has the basic equipment for speaking, Neanderthal did not. ■

NEW FOR INDUSTRY

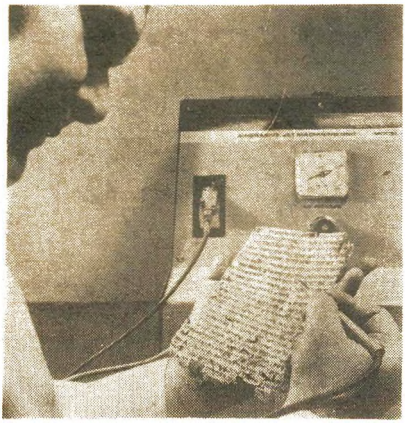


See-through mold teaches injection molding to apprentices

Operators of plastic injection-molding machines cannot watch the raw material they work with being transformed into an end product. But now, this experimental mold, invented by 15 apprentices at Kodak, lets beginners see how the molten plastic flows through the machine. The mold is also used by Kodak's engineers and draftsmen working on new products or mold designs.

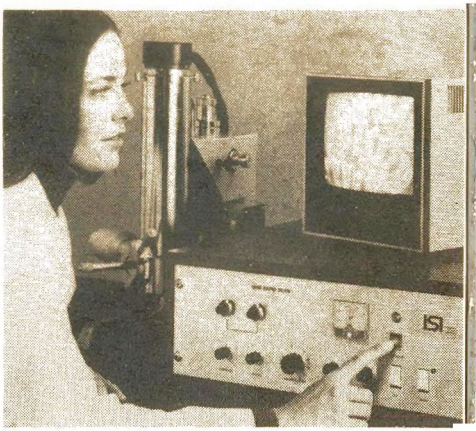
Primerless glazing sealant

General Electric has come up with a new one-part, primerless silicone glazing sealant that comes ready to use in caulkers. Called Silglaze, it will glaze glass, plastic or metal. The glaze requires no primer and GE claims it has a lightweight consistency which remains relatively unchanged over a temperature range of −135°F. to 140°F., which means it can be applied in any season. Because of its silicone base, Silglaze is unaffected by sunlight and ultraviolet radiation, rain, snow or other natural elements.



Cleaning up the scriptures

Airbrasive cutting equipment from S.S. White Industrial Products is now being used to clean rare bible fragments in Yemenite script. Normally, device is used to cut hard metals.



Electron microscope has TV scan

The first desktop scanning electron microscope with a TV scan has been developed by International Scientific Instruments. It costs $8900 and requires no training to operate.

Turbine-alternator runs cold

This miniature turbine-alternator from GE is shown here running at −442°F., only 18 degrees above absolute zero. The device is part of a new supercold military refrigerator.

NASA builds Mars globes

NASA scientists are shown here piecing together photo mosaic globes of Mars. The globes are being mapped completely from the 1500 photos returned to earth by Mariner 9.

NASA

book excerpt

The lure of SUNKEN TREASURE

What began as an inquiry into how life was lived in the old, sunken city of Port Royal resulted in the unexpected discovery of a king's ransom in gold and silver.

by Robert F. Marx

TO A MARINE archaeologist, the name Port Royal, the Jamaican city destroyed by an earthquake in 1692, generates as much excitement as the name Pompeii does to his land counterpart. Both cities met sudden destruction; one sinking into the sea, the other vanishing under lava, and it has long been thought that excavating their remains would yield valuable clues to our past. Pompeii yielded its clues some time ago, but those of Port Royal have remained hidden because, until recently, the world beneath the sea was unfathomable territory. But in 1965 the government of Jamaica announced that a large scale underwater excavation of Port Royal would begin in January of the following year. I was selected to direct it.

When I undertook the excavation of Port Royal it was not with the expectation of seizing treasure. Salvors flocked to the scene immediately after the earthquake, recovering valuables from submerged buildings with nets or grappling hooks. I was interested in recovering relics of old Port Royal with a view toward reconstructing how life had been lived in the lost city.

The town got its start in 1655 when Jamaica was captured from Spain by the English, who recognized that its position in the center of the Caribbean made it an ideal spot from which to attack Spanish fleets carrying the gold, silver and precious stones

Author Robert Marx (left) wades ashore with artifacts found in the sunken city of Port Royal, Jamaica. The gold rings (right) were part of a cache that included several thousand coins, all found on a seabed near what was thought to have been a silversmith's shop.

of the New World home to the mother country. Seasoned mariners that they were, the British invaders also recognized the strategic importance of a barren, sandy cay separated by a shallow marsh from a long, low sandspit curving south and west away from the mainland and almost enclosing a body of water. The harbor could accommodate more than 500 ships with ease. The English built their main stronghold on the cay, named it Port Royal, and the boom began.

It began with the arrival of the men who were the heaviest contributors to Port Royal's reputation for boozing, wenching, and brawling—the buccaneers. They were invited to make Port Royal their base by the English Crown which feared a Spanish attempt to recapture Jamaica. The Crown granted them letters of marque, authorizing attacks on Spanish ports and shipping as lawful privateers. Among the buccaneers was Henry Morgan, whose expeditions to Panama City and numerous ports on the Spanish Main earned him a knighthood. Port Royal continued to prosper even after the departure of the buccaneers in 1675, when the English Crown, at peace with Spain, rescinded all letters of marque.

Tuesday, June 7, 1692, in Port Royal dawned hot and sultry with a cloudless sky and the sea as still as a mirror. The weather made many inhabitants uneasy. Since the founding of the town, earth tremors had occurred almost annually. Every one of them had been felt during hot and windless weather. Shortly before noon, at 11:40 am by many accounts, disaster struck. There were three strong quakes in a matter of minutes. The third and most severe was followed by a huge tidal wave that caused nine-tenths of the town to sink or slide into the bay. By the time the sun went down more than 1800 homes had disappeared and all that remained above water was a mere ten acres of land in the shape of a small cay. [Ensuing years saw minor efforts at plundering and salvage by treasure hunters, but little serious archaeological work—Ed.]

The first part of my job was mapping the site of Port Royal, and I immediately ran into two problems. The first was Port Royal's waters, which are so murky that aerial photography or any other visual aids were useless. To locate concentrations of metal I relied on a metal detector; and to locate walls and other non-metallic objects, I relied on an eight-foot metal rod as a probe. The second problem was the sheer magnitude of the task. Even though I mapped only a portion of the site, an area roughly 200 feet by 300 feet in the section of old Port Royal where the jails, the fish and meat markets, the shops of the craftsmen and private houses had stood, the job took months.

On May 1, 1966, at seven o'clock in the morning, the dig began in a spot about 120 feet from shore. After removing only a foot of sediment, we turned up one artifact after another, and by the end of the first hour we had filled three baskets with clay smoking pipes, ceramic sherds, some unbroken onion bottles (so named because of their shape) and various coral-encrusted iron objects. We were off to a good start.

Our first major discovery was a fallen wall. As I excavated along one side of the wall objects began dropping into the hole I was making—a pewter spoon, then a pewter meat

platter with four pewter plates stacked neatly on top. Kanute Kelly, my chief lieutenant, crawled under the wall and emerged with a pewter tanker and a pewter plate. Kelly's recklessness worried me; that wall could fall on top of him at any time. I signaled my team to keep hands off the wall until it was level, then went around to the opposite side to pump away sediment there. At once I came upon a cluster of spoons. It was my turn to get reckless and I pumped deeper than I should. The wall toppled over, pinning my head and torso.

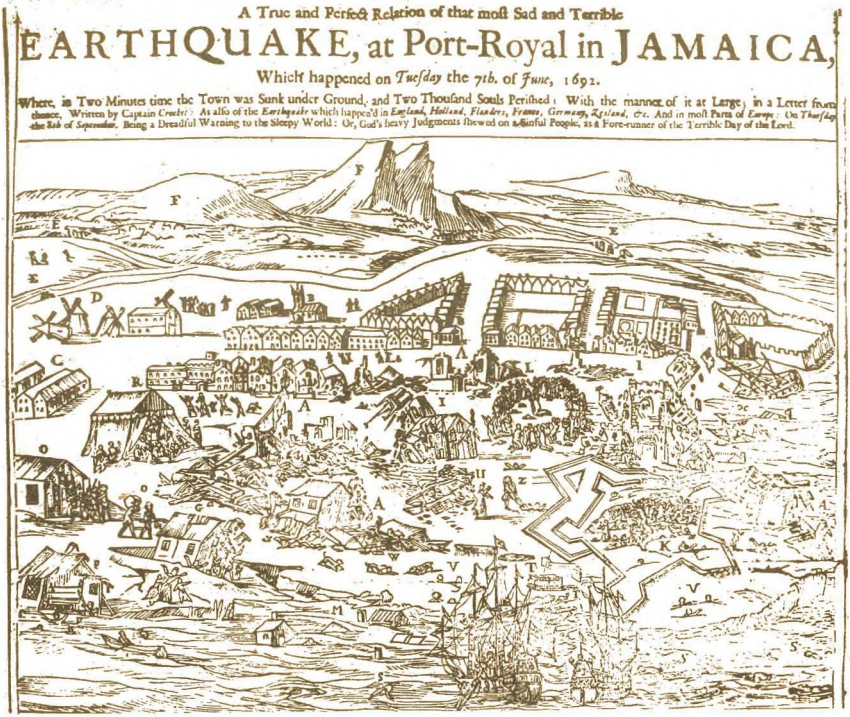
Luckily, it didn't break my air hose but it did smash the airlift tube. That told the boys on the barge that something was wrong and they sent Kelly to find me. He disconnected the air hose from the broken tube and used the air jet to blow away the sediment under my body. It was a risky maneuver but it worked. After that the rule was to take a wall apart before it could take you apart.

In the vicinity of the first wall we found six others of similar construction, along with seven roof beams. I was convinced we were working on the site of a single house. Whose house? When the 17th Century entered its closing decade, Port Royal had more than 8000 inhabitants and more than 2000 buildings, some of them three or four stories high.

But we had a clue to our house in the initials "RC" marked on two pewter plates and two pewter spoons found under the first wall. Consulting a map of old Port Royal, I discovered that a Richard Collins had owned property a stone's throw from where we found the pewterware. He must have either kept a tavern or rented part of his land to someone who did. In the area around the house we found quantities of onion bottles, ceramic beer mugs, broken wine glasses and more than 500 clay smoking pipes. The drinking paraphernalia could have belonged to a tippler with a lot of friends, but the clay pipes were another matter. No man would have owned *that* many! Many of them had been smoked so they couldn't have been stock from a pipe shop. The most plausible explanation was a tavern; in those days a man customarily left a favorite pipe at each of his favorite taverns.

Fairly soon I had a real mystery on my hands. We found thousands of artifacts from a ship—iron nails and caulking tools, brass fittings, copper wire and patching for covering holes in the hull. A week later we found the keel and ribs of a ship of 250 to 300 tons. The size of the cannon found nearby indicated that she was a warship. The brick walls found above and below a part of the keel indicated that she had sunk during the earthquake. Correspondence with the British Admiralty began. The only English warship reported lost during the earthquake was the *H.M.S. Swan*. She measured 74 feet in length and with a normal load her weight was 305 tons —statistics perfectly in keeping with our wreck. There was little doubt in my mind that our wreck was the *H.M.S. Swan*.

A major discovery such as the *Swan* invariably gave us a lift. The average working day consisted of grueling labor, and on some days the bucket came up with nothing but clay pipes and ceramic sherds. It consisted, too, of hazards. Our hands were frequently lacerated by sea urchins and by slivers of glass caught in the air lift screen. More serious than the cuts

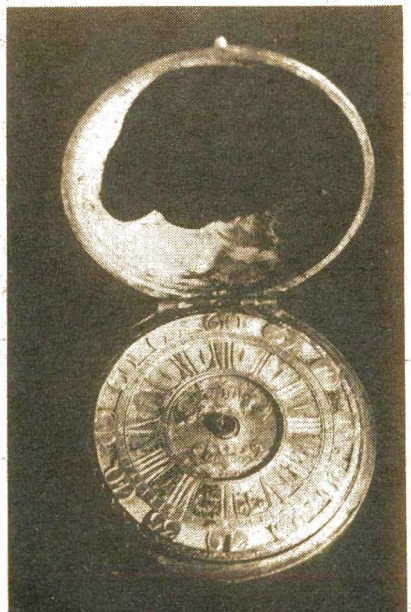

A True and Perfect Relation of that most Sad and Terrible

EARTHQUAKE, at Port-Royal in JAMAICA,

Which happened on *Tuesday* the 7th. of *June*, 1692.

Where, in Two Minutes time the Town was Sunk under Ground, and Two Thousand Souls Perished: With the manner of it at Large, in a Letter from thence. Written by Captain *Crosby*: As also of the *Earthquake* which happen'd in *England, Holland, Flanders, France, Germany, Zeland, &c.* And in most Parts of *Europe*: On *Thursday* the 8th of *September*. Being a Dreadful Warning to the Sleepy World: Or, God's heavy Judgments shewed on a Sinful People, as a Fore-runner of the Terrible Day of the Lord.

Above, a contemporary view of the Port Royal earthquake, published in a London newspaper in 1693. Below, a silver pocket watch, what the author called "the single most valuable artifact recovered during the entire dig." The watch is in perfect working condition. The author (below, opposite page) poses with various remarkably preserved pewter artifacts.



were the objects that fell from the collapsing sides of the hole. Adding to the hazards were some uninvited visitors. One day Kelly felt himself nudged from behind as he was surfacing out of the gloom. An instant later, a manta ray, twelve feet wide, embraced him with its wings. Kelly remained perfectly still until the manta ray, probably deciding Kelly wasn't much fun as a playmate, unfolded its wings and swam away.

Another time, I felt myself nudged from behind as I was working on the bottom. I reached out to push the intruder away and touched something that had the texture of sandpaper. I whirled to find myself looking doom in the eye—a large hammerhead shark. Possibly my sudden movement

scared it, or my rubber suit and face mask didn't make me a very appetizing morsel. In any case, it disappeared.

A high point of the dig was the discovery of two standing buildings. It took a full day to excavate the topmost five feet of the building, which was 34 feet long and 17 feet wide and had walls two feet thick. Before stopping work, I decided to complete my sketch of the building, since I knew there was every chance it would collapse during the night. The next thing I knew I woke up pinned under the wall, my mask gone. Fortunately, the weight of the wall had pressed my face against the purge button of my mouthpiece regulator and I had continued to receive air while I was unconscious. I struggled to push the wall off my back, but it was impossible to move. The only thing to do was to dig straight ahead with my hands.

It seemed years before my fingertips touched the end of the wall. I squirmed through my handmade tunnel until my arms and head were free. Then suddenly my regulator got caught between two bricks. I wasted precious minutes of my dwindling air supply in an attempt to free the regulator. Every second it became harder to breathe. There was only one chance. I jerked my body forward with every ounce of strength I could muster. The regulator snapped and I fought clear of the wall.

Several days after that I excavated a fallen wall and came upon the single most valuable artifact recovered during the entire dig. It was a round object so thickly encrusted with coral that I didn't have a clue as to what it was. An X-ray revealed the outline of a man's pocket watch, and removal of the coral revealed the watch was made of silver. Cleaning revealed its remarkable state of preservation. The watch face shone like a mirror, and

on it the name of the maker, Gibbs, and the place of origin, London, were as legible as they had been the day the watch left the workshop.

Almost immediately after we found the watch, the supply of artifacts ran out. I moved the dig, but for hours found only pieces of coral. Then I had to surface to make a telephone call. I had been on shore no longer than a minute when one of the team came running toward me, shouting that Kelly had found something great. The find was great all right—four silver Spanish pieces of eight, so well preserved that all the markings were clearly visible. Ordinarily, coins found underwater are so badly sulfated that even after cleaning their impressions are barely discernible. We found hundreds more, all in the same miraculous state of preservation. The miracle was explained when I found the remains of a wooden chest that had protected the coins over the centuries. The keyhole plate on the chest had the coat-of-arms of the King of Spain.

Research in the Archives of the Indies in Seville, Spain, soon told us how the chest of coins belonging to the Spanish Crown had gotten there. Documents revealed that just two years before the earthquake, three Spanish galleons had been wrecked near the island and treasure from these wrecks had been salvaged by Port Royal divers and fishermen.

The discovery of this unexpected treasure temporarily raised our spirits, but in the long run it proved to be a nuisance in many ways. Until that time our project had received little publicity on the island, but as soon as news leaked out we had found coins, the value of the find was magnified a hundred times. We lost several week's work while police chased away curious inhabitants and treasure seekers.

Then unfortunately, or fortunately —depending on one's viewpoint—we discovered another big treasure. This time we found several *thousand* Spanish silver coins in a remarkable state of preservation. We also found a great amount of silverware, gold rings and cufflinks, fragments of a large clock, and the most exciting of all—a beautiful 14-inch statue in Chinese porcelain of a woman holding a child in her lap. Research proved that it was the Goddess of Fertility and Childbirth, dating from the Kuan-Yin Dynasty and made in Tu-Hun, China. All evidence pointed to this being the site of a former pewterer's or silversmith's shop.

Once again our work was interrupted when word of the find spread like wildfire throughout the island. This time the police were not needed just to keep the curious from interrupting our work, but to protect our lives as well. The local criminal element entered the picture and threatened our lives if we wouldn't share our find with them. To add to the problem, the opposition accused the party in power of stealing the treasure. By the time it came up in Parliament for debate, the government was tempted to call a halt to the project, but the matter was finally resolved.

Our excavation continued with good results until the end of May of 1968, when I finally called a halt. We had labored for two and one-half years, but we barely made a dent. We had excavated less than five percent of the overall site. From the massive amount of archaeological data and information recovered from our work, most experts agree that Port Royal is the most important marine archaeological site in the West. ■

Stopping backaches without surgery

A recently tested enzyme called chymopapain, a drug which digests disc cartilage, may now help chronic back sufferers avoid orthopedic surgery. The drug reduced severe back pains in 75 percent of those patients treated.

by Charles Berkley Folds

EVER since Paleolithic man stood up on his hind legs to walk, he and his descendants have been plagued with what is now called the most chronic ailment in America today—the backache.

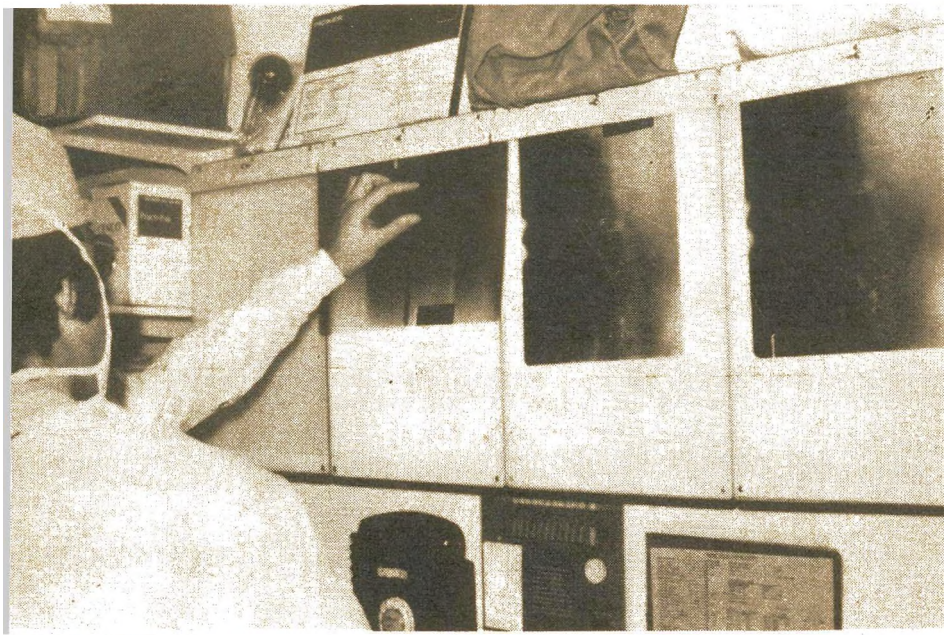
Medical reports show that one out of five afflicted persons takes his aching back to a doctor each year. This common, sometimes crippling disease can strike men and women, young or old.

Most back problems can be controlled by bed rest, heating pads, massage therapy, braces, corsets and painkillers.

One out of every hundred sufferers requires surgery. Usually this is a patient who is diagnosed with a ruptured, slipped, sliding, or protruding disc, who does not respond to conservative treatment.

The physician (an orthopedic surgeon or neurosurgeon) performs an

One ailment that might require surgery but could be treated instead with chymopapain, is a bulging disc (shown below) which exerts pressure on the nerve root, causing pain.
Charles Folds



Charles Folds

Prior to chymopapain injections, the patient undergoes a series of special X-rays so experts can determine exactly where drug should be inserted. Above, physicians study lumbar X-rays.

operation known as a laminectomy or discectomy. The doctor makes an incision in the lower portion of the patient's back and removes the damaged disc. This operative process lasts approximately one to two hours. Recovery is slow. On an average, it is about four to eight weeks before the patient can return to full working ability and normal activity, providing the operation is successful.

Until recently, this method was the only surgical procedure available for back sufferers.

Now a new knifeless, bloodless treatment, known as chemonucleolysis, is being performed in 20 states by a handful of specially trained orthopedic physicians, and with a success rate equal to or greater than surgery.

Hailed as a major medical breakthrough in chronic back problems, chemonucleolysis is an experimental process in which long needles are inserted into the patient's back and an enzyme called chymopapain injected. The chief ingredient in chymopapain is papain, extracted from the tropical fruit papaya.

For decades the Polynesians have wrapped their meat in papaya leaves to make it tender. Papain is found in most meat tenderizers used throughout the U.S. today.

Dr. Lyman Smith, assistant professor of surgery at Northwestern University, coined the word chemonucleolysis. After considerable animal experimentation, Dr. Smith treated the first humans in July of 1963. Since that time, he has trained more than 30 orthopedic surgeons throughout

the United States in the procedure. To date, more than 9000 patients of all ages have been treated with the chymopapain injections.

The main advantage of this procedure is that you can avoid the prolonged bed rest and the back pain that comes from surgery. Chemonucleolysis also presents an alternative to the patient who cannot emotionally tolerate the idea of going through surgery.

One of the doctors administering chemonucleolysis is Dr. David Teperson, a young orthopedic surgeon in Hollywood, Florida, and presently the only physician in that state authorized to perform the procedure.

"All of us relate to our back," states Dr. Teperson. "We have somehow taken it for granted; it is there, will function nicely no matter what work or activity we engage in, until one day we bend over the wrong way or lift or throw something awkwardly, and ouch!—excruciating pain."

Teperson has performed about a hundred chymo injections. Many of his patients were awaiting routine back surgery or had already had an unsuccessful operation.

He prefers to perform the experimental procedure as opposed to surgical methods. Teperson feels that the patient can always have an operation if the injections fail.

Prior to the injections, the patient is given a general anesthesia. By use of special X-ray techniques and TV monitoring, the entire experimental procedure and proper placement of the needles is well controlled. This insures that the enzyme is injected into its proper place.

The chymopapain remains active in the human body about 30 seconds. The enzymes are used up in digesting disc cartilage. The drug does not affect any of the other surrounding tissue or nerves.

After the injections the needles are left in place for five minutes and removed. The patient is then awakened and wheeled to the recovery room; rate of success is about 75 percent.

The main side effect to chemonucleolysis experienced so far is an allergic one. This occurs in approximately one out of a hundred patients. The reaction is controllable so that no severe complications result.

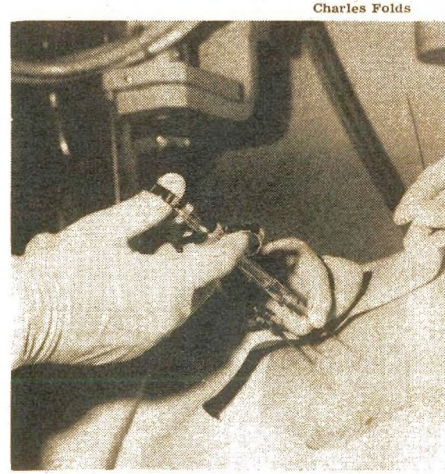
Other complications which have arisen include paraplegia, the Brown-Sequard syndrome (infarction of the spinal cord), shock and infection.

Teperson's patients haven't experienced any serious reaction to the drug.

"Of course, everybody doesn't benefit by a complete cure," says Dr. Teperson, "but most doctors doing the procedure strongly feel it should be tried before surgery, since the possible risk of allergic reaction to the

Below, doctor injects chymopapain into patient who is under an anesthetic. After injections, needles are left in place for five minutes and removed; drug works quickly.

Charles Folds



injections, which is controllable, is preferable to the known risks and complications of surgery."

Dr. Teperson as well as his colleagues, maintain a thorough checkup scheduled on all patients who have received the injections.

One of his patients is Jeanne Moman, an attractive 42-year-old insurance adjustor. Her equestrian skills came to a sudden halt one day when she found herself racked with excruciating low back pain. Several other doctors diagnosed her as having a herniated disc. Surgery was recommended. Mrs. Moman had heard of the experiments with papaya enzymes through her insurance company.

On October 10, 1972, Jeanne entered the special procedures room at Doctor's Hospital in Hollywood, Florida. Dr. Teperson inserted three long needles into her spine and injected the chymopapain. The entire process lasted less than half an hour.

Five days later Mrs. Moman walked out of the hospital. In four weeks she was back at work, able to touch her toes and ride her horse. She didn't experience any more pain.

Whether or not the enzymes have a favorable effect on any other physical problems remains a mystery. However, one patient receiving the injections was cured of a pre-existing foot-drop.

Gerard Dubuc, 60, had already had an operation for the removal of a disc, which was unsuccessful. On June 21, 1972, he received the chymopapain injections. In six weeks he returned to work. "It was like a miracle," said Mr. Dubuc.

William Turcotte, a sprightly lad of 17, was working in a department store auto shop one day. He picked up a tire and tossed it. When he did, he felt a piercing pain shooting from the lower portion of his back and down the right leg. He saw an orthopedic surgeon and a laminectomy was performed . . . unsuccessfully.

The pain re-occurred, in the same place. On October 30, 1972, Dr. Teperson injected the chymopapain into young Turcotte. Three weeks later he had no low back pain or leg pain, and he was able to touch his toes. Recently he was advised he could return to work.

Some insurance companies are skeptical about the whole thing. "This happens with any new medical discovery," states Dr. Teperson. "We're awaiting Food and Drug Administration approval for general distribution of the drug, and from the results, this shouldn't be too long."

Claudia Orlando, a beautiful redheaded housewife with a new baby, feels the procedure is something special. She was unable to lift her infant and couldn't sit or stand without pain in her right leg. On Wednesday morning August 18, 1971, Mrs. Orlando was treated with the enzymes. The next day she got up out of her hospital bed and walked happily down the hall. Eight years of postponing surgery ended with the injections. She remained in the hospital only one week and can now function fully as a wife, mother and enjoy life a lot more.

As Dr. Lyman Smith stated in his summary of clinical studies on this procedure: "It is my opinion that chemonucleolysis, with rare exceptions, should be used in all cases of severe low back pain and sciatica, after conservative treatment has failed and before surgery is considered."

Someday, the majority of back operations being presently performed may prove to be unnecessary. ■

ISAAC ASIMOV EXPLAINS

Each month Dr. Asimov chooses questions you send in to answer. He does not make his job easy, for he covers theoretical physics to biochemistry and he has written on topics from anti-gravity to biological clocks to what happens when an irresistible force meets an immovable object. Following Dr. Asimov's answer are the answers to some of your questions written by regular members of the *Science Digest* staff.

The first virus detection

How were viruses discovered?

IN THE 1860s, the French chemist Louis Pasteur advanced the germ theory of disease. According to this theory, every contagious disease was caused and spread by some tiny form of life that multiplied in the sick organism, passed from that organism to a healthy one and made it sick in turn.

In the 1880s, however, Pasteur was working with the deadly disease rabies (also called hydrophobia) and found that although the disease was contagious and could be contracted from the bite of a rabid animal, he could find no germ associated with it. Pasteur concluded that there was a germ all right, but that it was too small to be seen by the microscopes he had.

Other diseases also seemed to lack a germ, possibly for the same reason. An example was tobacco mosaic disease which attacked tobacco plants and which produced a mottled mosaic pattern on the leaves as a symptom. If the leaves were mashed up, a juice could be extracted that would produce the disease in healthy tobacco plants, yet that juice contained no germ of any kind that could be seen in a microscope.

How far could microscopes be trusted at the limits of visibility? A Russian bacteriologist, Dmitri Ivanovski, tackled the matter in another way in 1892. He used a filter of unglazed porcelain that would stop anything large enough to be seen in a microscope of that day. He forced the infectious extract from diseased tobacco plants through such a filter and found that what came through could *still* infect healthy tobacco plants. Ivanovski thought that perhaps the filter was defective and didn't quite dare to conclude there were germs too small to see in the microscope.

In 1898, a Dutch botanist, Martinus Beijerinck, independently tried exactly the same experiment and got exactly the same result. He accepted the validity of the experiment and decided that whatever it was that caused tobacco mosaic disease, it consisted of particles so tiny that they could pass through the filter.

Beijerinck called the disease-causing liquid a "virus" from a Latin word

for a poisonous plant extract. Because it could pass through a filter without losing its poisonous quality, he called it a "filtrable virus." The term eventually came to be applied not to the liquid but to the disease-causing particles within it. Then the adjective was dropped and the tiny disease-causing particles were simply called viruses.

But how big were the virus particles anyway? Beijerinck thought they might be not very much larger than water molecules so that anything that would let water pass would let the virus pass, too.

This was put to the test in 1931 by a British bacteriologist, William Elford. He used collodion membranes which could be prepared with microscopic holes of any size. He passed virus-containing fluids through collodion membranes and found he could prepare a membrane with holes so tiny that the water molecules passed through, but not the virus particles. Elford found that although the original liquid transmitted the disease, what passed through that filter could no longer transmit it.

In that way, the size of the virus particle came to be known. It was smaller than the smallest cells; so small that it might only consist of a few molecules. Those molecules, however, were giant molecules.

—Isaac Asimov

Why do some plants inhibit the growth of others?

To all appearances the plant world seems a peaceful one, but botanists know that some plant species literally poison their neighbors.

Plant-world counterparts of the infamous poisoning Borgia family of human history are the prairie sunflowers. They not only poison such innocent neighbors as grasses and wild flowering plants, but they poison one another. The reason sunflowers in the center of a large perennial plot seldom do as well as those on the edge is that they are completely surrounded with dangerous relatives.

There is of course, a sober scientific explanation for these murderous antics. It is simply that the sunflower and a few other plant species produce chemicals which are liberated into the soil when the decay of dead roots take place. These chemicals inhibit growth.

Botanists have found that the poisonous substance does not maintain a poisonous condition in the soil from one year to the next but must do its lethal work in the spring. This is when the decomposition of old roots is most rapid and when the new buds are beginning growth.

Although two Wisconsin scientists, J. S. Stickney and P. R. Hoy, reported as long as 70 years ago that a black walnut tree holds back the growth of small plants in its immediate vicinity, botanists have not made any extensive studies as to the number of such antisocial plant species. It appears however, to be a widespread phenomenon.

Other plants in the same category are some of the desert shrubs, the absinthe plant native to Europe, and the desert plant from which guayule rubber is obtained.

In Wisconsin, some of the woodland asters are among the group, including the woods or heartleaved aster, which is sometimes used in gardens. The Indian tobacco plant is perhaps one of the most common. ■

Growing shellfish with garbage

by Ellen R. Hartley

Now oceanographers have found a way to get rid of garbage and at the same time grow some pretty expensive food for our tables. A team of scientists at the Woods Hole Oceanographic Institute (Massachusetts), has been feeding garbage (mixed with nine parts water) to various kinds of algae, which have rapidly proliferated on this diet. The scientists then fed the algae to some highly marketable shellfish—oysters, mussels, scallops and clams.

The present small-scale operation at Woods Hole, begun in October, 1969, has shown so much promise that the scientists will soon be moving to a larger facility, where the system will undergo final testing in environmental conditions similar to a commercial operation.

The concept of using animal and human waste to fertilize fields and increase the production of food for man and animals (which, in turn, would become another source of food for man), is as old as agriculture itself. The Woods Hole scientists are using the same principle in sea farming (or aquaculture). They have found ways of using treated garbage to produce animal food; the resulting by-products being (a) a commercially valuable crop of shellfish, (b) large seaweeds, of value for their extracts, (c) bait worms, and (c) bottom-feeding fish, small shrimp, and lobsters.

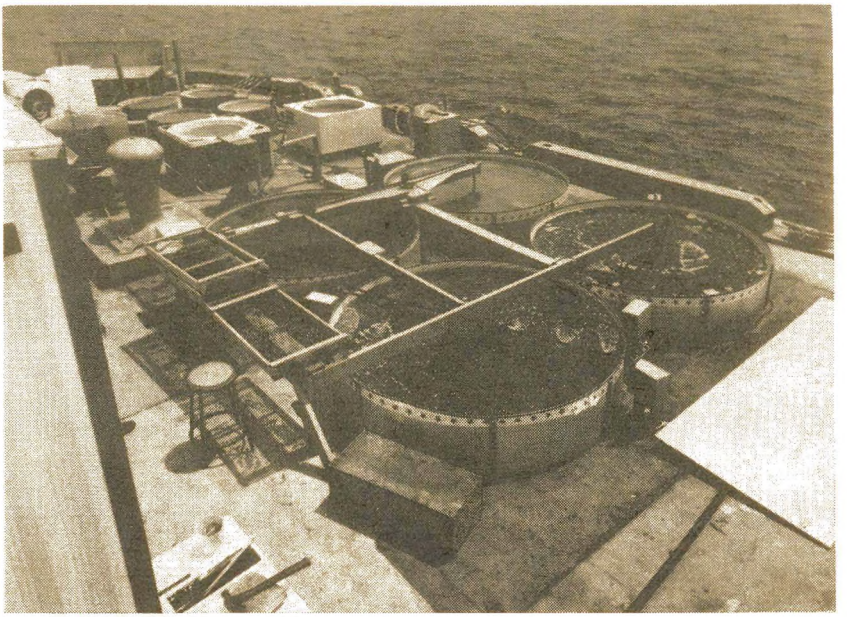
Dr. John H. Ryther, project director and leader of the team, believes that once the system is fully developed and put into operation, the sewage of a 50,000-population community could be converted into a harvest of about 900 tons of oyster meat yearly—representing a market value of millions of dollars.

After experimenting with 50 different types of treated sewage, and finding only one kind that is toxic to the primary crop of algae, the team decided to use sewage that had undergone a secondary type treatment which oxidizes and mineralizes organic wastes. Dr Ryther says that the properly diluted secondary treated sewage provides "an excellent culture medium for marine phytoplankton algae. In many respects, this kind of algae growth is an improvement over that which is obtainable from the best-known artificial sea water enrichment . . . "

The algae is transferred to a food reservoir where it is mixed with fresh sea water before finally being sent into the shellfish growing tanks.

Among the problems the researchers had to solve before their system could be put into operation was to find the proper balance between the amount of sea water, phytoplankton algae, and sewage on which the algae would feed. They had to determine how much to dilute the resulting algae-food with fresh sea water to insure rapid growth of the various shellfish. Flow rates had to be established, engineering problems solved. The entire physical configuration of the project needed to be worked out.

With these (and many other) problems solved, the initial shellfish feeding experiments were most encouraging. Oysters did particularly well. The Woods Hole scientists report that ". . . over a period of 30 days



Circular tanks above are "seafarms" in which algae are cultivated on a diet of secondary sewage diluted in sea water. Culture is recirculated to keep cells suspended and provide aeration. White food tanks in background store algae for future consumption by shellfish.

. . . the oysters removed 77 percent of the algae entering the system and converted 22 percent of the filtered cells to new oyster flesh. If this efficiency can be maintained or increased, the general performance of the system could be considerably improved. . . "

Early in 1971, the team moved their project from a laboratory environment to outdoor facilities designed to test the system under natural conditions. The planned expansion of activities became possible through construction grants for the pilot plant system from the Ford and Rockefeller Foundations. Operating funds are provided by the National Science Foundation.

Constant monitoring of the system provides ways of determining food utilization and nutrient regeneration of the algae as well as the shellfish crop. To create a more normal ecosystem in the growing tanks, marine worms and flounders have been introduced in some of them, small shrimp and lobsters in others. (They feed on the debris of the shellfish with whom they share living space. In an ideal ecosystem nothing is wasted. The marine worms will grow into prized bait for fisherman.)

One fact continues to trouble the scientists. Oysters and other shellfish are easily polluted by virus, bacteria, traces of metals, and a host of potentially dangerous or unpalatable organic compounds.

The team is deeply involved in monitoring the passage of metals,

Above, two marine biologists monitor the growth rate of oysters feeding on diluted algae. The oysters are suspended on special frames for observation purposes, and thus far, experiments have also been successful with clams, mussels and other edible shellfish.

such as mercury, cadmium, etc., and other substances through the entire chain; from sewage to phytoplankton algae, and from algae to shellfish, bottom feeders, etc. They have discovered some evidence that algae may kill bacteria but, says Dr. Ryther, "That's something we still have to look into further."

So far, detoxification of shellfish has not been found necessary, and is not currently planned. As a matter of fact, shellfish normally do a good job of detoxifying themselves. Placed in fresh sea water, an average oyster allows some ten gallons of sea water to pass through its system daily, a process which filters out the nutrients that sustain it. This would automatically get rid of any potential coliform bacteria. Sometimes, however, shellfish will not pump at all, which means detoxification time, depending on what is to be purged, may vary from days to years.

The Woods Hole scientists point out that the experience gained from their activities provides only the basic data on a small scale operation. They expect new problems to develop when they enlarge activities to a realistic pilot plant-sized operation. At the same time, they admit that their system "appears to have functioned extremely well from the outset."

Hopefully, it will continue to do so. Increasing world production of high protein foods and waste disposal are two of our most pressing international problems. ■

ECOLOGY

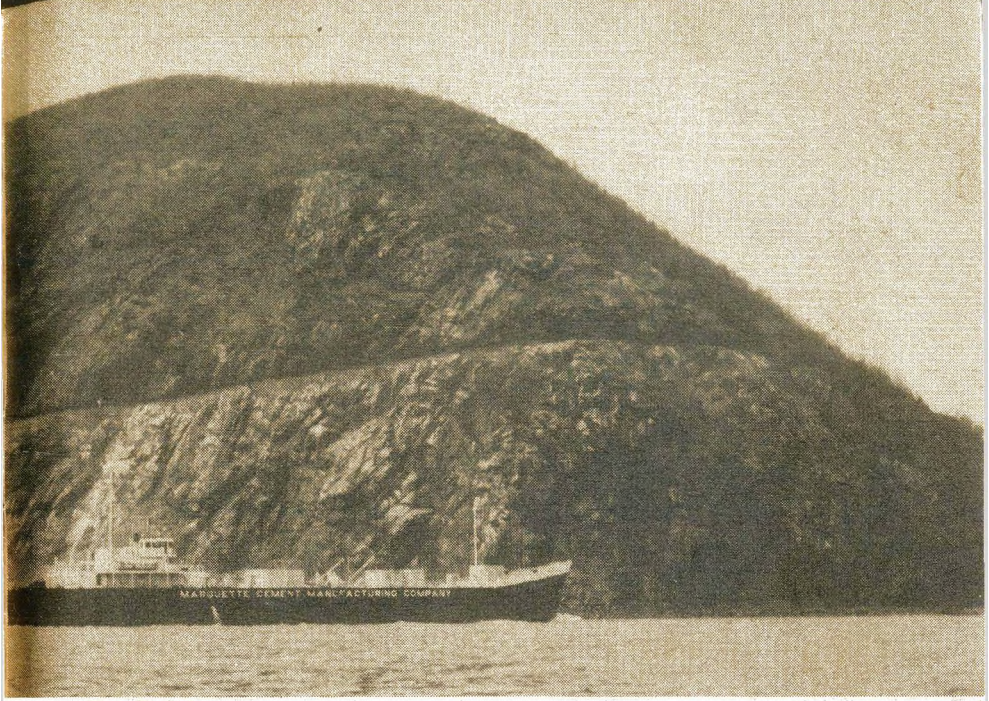
Storm over Storm King Mountain

Environmentalists are up in arms over the proposed site of a giant hydroelectric plant on the Hudson River. Utility experts say it could eliminate black-outs. Ecologists say it could also disrupt the surrounding balance of nature.

by Kenneth Anderson

RIGHT NOW, America's largest electric power company, Consolidated Edison of New York, is beginning construction of one of the world's largest pumped-storage hydroelectric plants on the Hudson River. As presently designed, the Con Ed facility would draw about eight billion gallons of water daily through a two-mile long tunnel, 40 feet in diameter, to a reservoir where it would be held until needed to generate electricity; this would be accomplished by letting the water rush back down the tunnel to the Hudson River, spinning generators along the way.

All of this probably sounds simple enough. But the fact is that Con Ed has been trying to start construction of the Storm King Mountain pumped-storage plant since 1963. But each attempt has been beaten back by a well-organized confederation of conservationists that has included The Sierra Club, The Izaak Walton League of America, National Audubon Society, National Parks and Conservation Association, The Wilderness Society, and the Scenic Hudson Preservation Conference. In what has probably been the most protracted conflict between conservation groups and a pri-

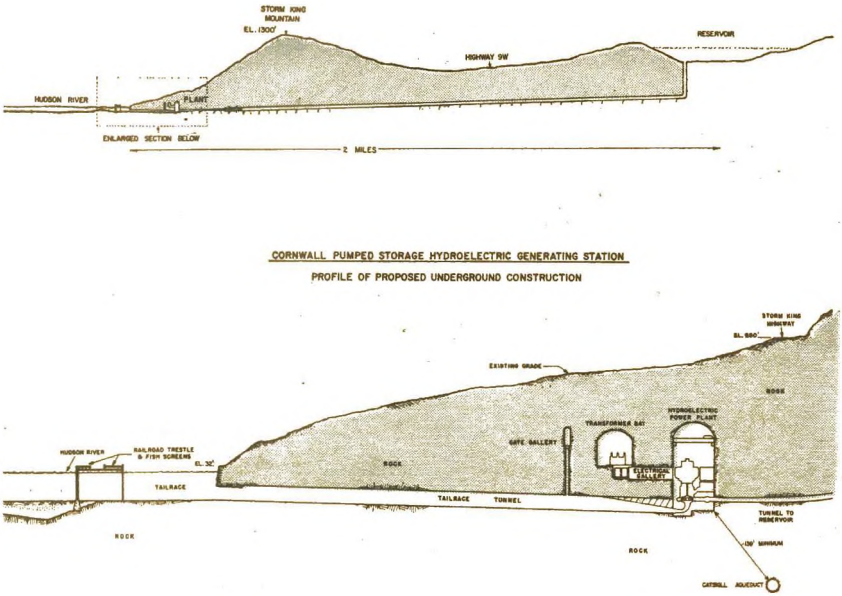


Storm King Mountain, focal point of a stormy controversy between the nation's largest electric company and ecologists.

vate utility, the battle of Storm King Mountain has been fought to the U.S. Supreme Court and back, enlisting scientists, sportsmen, and other interested parties from 20 countries. The hearings before various legal bodies have consumed 25 weeks of testimony and arguments, filling some 20,000 pages of court records. And some ardent conservationists have announced that more skirmishing can be expected before the projected completion date in 1979. Storm King Mountain, about 50 miles north of New York City, is hardly distinguishable from the rest of the neighboring Hudson Highlands. It is a 1355-foot high lump of gray gneissoid granite that has been around for at least 200 million years and was on at least two occasions, according to geologists, buried under 2000-foot thick glaciers. The Dutch settlers of the area named the granite lump Butter Hill.

According to some observers, the present controversy about Storm King Mountain is due in part to a little known 19th century writer, Nathaniel Willis, who was responsible for changing the name of the site from Butter Hill to Storm King Mountain; Willis disliked the old Dutch place names and thought Storm King Mountain had a more dramatic ring. It would be much more difficult, as one spokesman explained, to rally public opinion against plans to drill a hole through a granite bluff called Butter Hill. And Con Ed, never at a loss to exploit a public relations idea, has now published a brochure in which the site is identified as (would you believe?) Butter Hill.

One of Con Ed's arguments for the need of a pumped-storage hydroelectric plant is that its customers in New York City and suburban Westchester



Schematic view of Con Ed's hydroelectric project (top) shows where plant will be built—underground—with a two-mile tunnel to the water storage reservoir. Water will be pumped into reservoir at night, when energy demands are low, and flow back through reversible turbines during the day to meet energy needs. Below, details of plant facilities.

County sometimes require about 7.5 million kilowatts of electric power during a summer afternoon when all available air conditioners are in use. But after the summer sun goes down, the demand may drop below four million kilowatts. This situation frequently leaves Con Ed with the ability to produce three million kilowatts of power that nobody needs in the middle of the night. But when all the electric toasters, air conditioners, elevators and subways are turned on the following morning, the demand quickly pushes back toward the 7.5 million kilowatt level. Why not, reasoned Con Ed engineers, use the excess power available at night to supply a pumped-storage plant? With the reservoir behind Storm King Mountain filled overnight, up to two million kilowatts of instant power generating capacity would be available in the morning. Gravity would pull the water back down to the Hudson River and the same equipment used to pump the water into the reservoir would convert the energy of the rushing water into electricity. "It would be like a giant storage battery," Con Ed explained to the public.

But, the conservationists declared, there's a catch. For every two kilowatts of power generated by the pumped-storage plant, Con Ed uses three kilowatts to pump the water up to the reservoir. And to provide two million kilowatts of power from Storm King Mountain generators, Con Ed has to run its conventional

fossil fuel and nuclear generators all night, adding to the air and water pollution problems in the New York City area. Con Ed agreed that it would be a three-for-two tradeoff, but argued that it's not the losing proposition described by conservationists. The three million kilowatts would come from installed capacity —in other words, from the same generating plants that are used during the day; those plants may reduce output during the night but they are not shut down during slack demand periods, they simply continue operating at less than full capacity. It would be less feasible to follow an alternative, suggested by some conservationists, to create an additional two million kilowatts by using fossil fuel or nuclear generators to meet peak needs.

Also, Con Ed contends, pumped-storage generators provide the most effective means of producing large amounts of electricity on short notice. When additional electricity is needed through conventional methods, somebody has to provide the coal, oil, or nuclear energy to produce heat for a boiler; water has to be added to make steam, and there is a period of waiting for steam pressure to build up so it will spin the turbines. If there was a sudden threat of another blackout like the one that hit the East Coast in November, 1965, steam generators could not be cranked up fast enough to prevent a power failure. But with a pumped-storage generator installation, billions of gallons of water could be released simply by pushing a button and the man-made waterfall could feed electric power into the grid in approximately one minute.

Con Ed estimates the 1965 disaster could have been prevented if a "spinning reserve" of 750,000 kilowatts of power had been available to hold the line until other generating capacities could have been stepped up; a pumped-storage generating plant could have provided that vital "spinning reserve."

One issue that has attracted international concern is the effect the pumped-storage plant would have on normal fish life in the Hudson River. Technically, the Hudson River is a tidal estuary and the flow of saline waters from the Atlantic Ocean make the Hudson an attractive habitat for many species of salt water fish. More than 30 species of fish move between the Hudson River and the Atlantic Ocean, including such offbeat game fish as the mangrove snapper, which ordinarily does not venture beyond the Gulf Stream. The more important species are striped bass, shad and sturgeon, which move into the Hudson River to spawn.

Most of the attention has focused on the striped bass, which spawns over an 80-mile stretch of the Hudson, although some experts claim that most of the spawning activity takes place within an eight-mile portion of the river near Cornwall, N.Y., a community near the base of Storm King Mountain. The Scenic Hudson group, one of the more vocal opponents of the pumped-storage project, contends that fish eggs, larvae and fingerlings would be sucked into the tunnel by the powerhouse pumps or hurtled through turbine blades to be reduced to "scrambled eggs and fish meal."

Con Ed has argued that studies by the New York State Conservation Department, the U.S. Bureau of Sport Fisheries, and the U.S. Fish and Wildlife Service have found that no significant change in Hudson River fish life will result from operation of the

Storm King Mountain hydro project.

There is one peculiarity about striped bass that could make the species vulnerable to pumped-storage operations, in the opinion of conservationists. Most of the fish that spawn in the Hudson have eggs that are adhesive and tend to stick to the river bottom. But the eggs of striped bass (as well as shad, which spawn about 30 miles upstream from the power plant site) are non-adhesive and tend to be suspended in water that moves at a velocity of at least one foot per second; normal Hudson River currents range from 1.4 feet per second at flood tide to 1.8 feet per second at ebb tide, which is more than enough movement to keep the striped bass eggs stirred up. Con Ed claims that peak velocity of water discharged from the Storm King plant would be about one foot per second and the intake velocity would be less, about ¾ feet per second. So, the intake and discharge velocities would be less than the natural tidal flow of the river. However, the company agreed to install a protective fish screen with ⅜-inch square openings to filter out as much aquatic life as possible. And the total loss of striped bass eggs through the pumps has been estimated at a possible 80 million per year, an impressive figure except that only 160 adult striped bass could produce this many eggs in one season.

Con Ed also has offered to contribute a fish hatchery large enough to replace the anticipated loss of striped bass eggs. A fish hatchery would not be a big ticket item for Con Ed, which already has seen costs for the Storm King Mountain project skyrocket from $165 million in 1963 to $457 million in 1973.

One irony frequently overlooked by opponents of the pumped-storage project is that when operating costs go up, the additional expense is passed along to the customers. In this case, Con Ed customers will pick up the tab for several hundred million dollars of added expenses.

Another argument advanced by conservationists against construction of the Storm King project is that any water that might leak from the pumped-storage reservoir would contaminate the plant life in the nearby Black Rock Forest Preserve. But Con Ed has replied that the plants in the forest preserve are the same species that grow along the banks of the salty, polluted Hudson River.

One of the weaker arguments of the conservationists has been the contention that Storm King Mountain is an important scenic and historic site. If there is a specific point of history associated with Storm King Mountain it is not mentioned in the 1973-74 editions of the brochures distributed by the Hudson River Valley Association to attract tourists to the region. One of the Association's brochures lists no fewer than 113 places in the region that tourists should visit; the nearest historic site is Newburgh, a Revolutionary War headquarters, several miles to the north.

The U.S. Court of Appeals held in a 1971 decision that if the Storm King Mountain area was truly regarded as a "green haven," conservation-minded people should have taken action long ago to make the site a State or National Park. The finding echoed a Federal Power Commission statement that "had the people in the area already spoken (to have the area declared a State or National Park) we probably would have listened and might well have refused to license it

The hearings before various legal bodies have consumed 25 weeks of testimony and arguments.

[the power plant]." One FPC examiner in fact spent two days cruising along the Hudson River around Storm King Mountain and reported the area was hardly the scene of natural beauty the public had been led to believe. Instead, the investigator said, he found a continuing vista of railroad tracks, highways, bridges and trestles, docks and river shore pilings, barges, standpipes, sewage disposal plants and boat houses. He noted particularly that the mountain had been marred for years by a state highway that "rips high up and half around the face of Storm King." He added that the west bank of the Hudson River had become such a hinterland slum that Con Ed's proposed hydro plant might actually improve the "natural beauty" of the area.

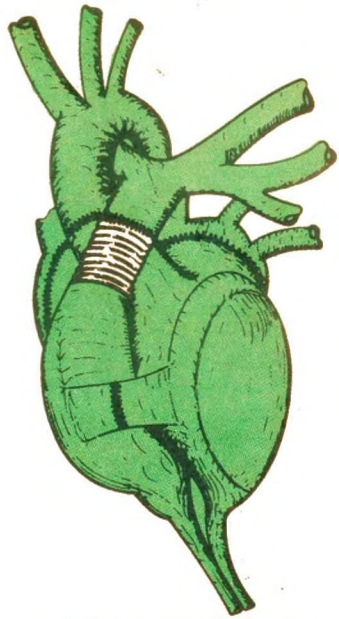
The Con Ed plan actually provides for a 57-acre landscaped park with a scenic overlook, play areas, picnic sites, weather shelters and boat launching facilities for the public. The powerhouse will be underground and hidden from view except for the 40-foot-high entrance portal and tailrace, most of which would be concealed by trees and shrubbery. But the concealed powerhouse and landscaping were concessions made to the conservation groups; much of the original installation would have been located aboveground.

New Yorkers, who have grown accustomed to blackouts and brownouts because of inadequate power supplies in past years, are beginning to turn their scorn from Con Ed, the traditional scapegoat for electric failures, to well-meaning conservationists. When the great blackout of 1965 occurred on a mild, moonlit November night, the sudden total loss of electricity was a novel experience that blossomed into a festive occasion. Candles and flashlights were fished out of closets and cabinets and hungry citizens picnicked on whatever foods they could find that required no cooking. They slept on subway or commuter trains stalled along darkened tracks or engaged in all-night card games by candlelight. But, as in the case of other all-night parties, the "fun" aspects of power failure had worn quite thin by the following morning when elevators still were not working, toilets would not flush because there was no electricity to pump water into standpipes, and service station gasoline pumps were useless.

It soon became evident that despite much talk about flushing modern civilization down the nearest sewer and returning to a primitive "natural" lifestyle, most people actually would not want to butcher their own cows, walk to town for a bag of flour or dig latrines downstream from the backyard water pump. And while everybody is in favor of conservation, most really would not give up TV, air conditioning, and electric refrigerators in order to save striped bass fingerlings or to protect a few suburban landowners from the sight of electric transmission lines. And the price of conservation efforts will merely be paid eventually in higher electric bills. The Storm King project represents more than just a local conflict of interests. It reminds us of the problems we'll face in the future. ■

INVENTIONS & PATENTS

DeBakey invents artificial heart



DeBakey's artificial heart

Dr. Michael E. DeBakey, the first surgeon to perform a heart transplant in this country, and one of his associates have invented an artificial heart which can be implanted as a total replacement for the human organ.

DeBakey is also well known for his public feud with Dr. Denton Cooley, the surgeon whom DeBakey criticized for implanting an artificial heart in a human patient back in 1969, an operation which subsequently failed.

But now DeBakey, chief surgeon at Baylor University College of Medicine in Houston, Texas, has invented his own artificial heart. He was helped in the project by Dr. C. William Hall of San Antonio. The research was financed with federal funds.

Researchers have performed experiments with calves, but so far the mechanical heart has not been implanted in a human body. Dr. DeBakey says that there has been only limited success with animals and that research was continuing in an effort to reduce blood damage and to attain longer survival. Refinements have been made in the working model.

The artificial heart is described as being lined with impervious Dacron and as having left and right ventricular pumps operable at different and controlled pressures. The Dacron is embedded in Silastic, a heat-vulcanizable silicone rubber.

Installation of the artificial heart is comparable to human heart transplantation. In the formal language of the patent, this is the procedure: "The heart is excised, a posterior cuff of the left and right atria, atrial septum, ascending aorta, and main pulmonary artery of the biologic heart being left in the recipient. The prosthetic heart is attached to the recipient by a continuous suture, beginning with the atria and proceeding around the septum. The aorta and pulmonary artery are joined to the outflow connector from the left and right ventricles, respectively. Air is evacuated from the chambers, and the pumps are energized."

The patent is assigned to the Department of Health, Education and Welfare, whose National Heart and Lung Institute is following the project.—*Stacy V. Jones*

Navy develops synthetic skin for burn victims

A synthetic skin that can be used in place of human tissue to treat severe burn wounds has been developed by the Navy. The new material, a thin, cellophane-like polyester film, is inexpensive and can be produced in large quantities.

Normally, burn wounds are covered with human skin from donors and specially prepared pigskin. The main reason for covering wounds immediately is to reduce excessive evaporation of body fluids. The loss of fluids delays healing and increases the patient's susceptibility to respiratory diseases, one of the major causes of death in burn victims.

Human skin and pigskin, however, are expensive and difficult to obtain and must be changed every few days as the human body tends to reject these materials.

The new synthetic covering, according to the Navy, can be absorbed and synthesized by the human body with no symptoms of tissue rejection. So far, the material has been used only on laboratory animals, but with promising results in its ability to control the loss of body fluids.

Water wings for helicopters

An idea for equipping helicopters with giant water wings is showing promise of saving lives and equipment when these top-heavy craft make emergency landings at sea.

Often when a helicopter is forced down at sea, it will flip over quickly if it hits the water at an angle even a few degrees from vertical. These sudden turnovers make it hard to escape.

But now the Southwest Research Institute for the Office of Naval Research is developing the idea of gas bags that are stored in cylinders at the sides of the helicopter which can be inflated before water impact.

The system is being designed for the Sikorsky CH-53A Marine helicopter. So far, only a model (based on the CH-53A) has been tested—dropped into a water tank from various heights and angles. Fitted with the gas bag system, the model stabilized upon impact in the water when dropped at angles up to 30 degrees from the vertical.

Robot-in-the-restaurant

by Irene Agnew

COMPUTERIZED restaurants are no longer a novelty in Moscow, where it is estimated that around 270,000 people eat lunch in a restaurant every day. The Rossiya Hotel, one of the more elegant establishments in the city, now has a computer capable of preparing as many as 10,000 different dishes for its dining room. Since the average requirement for most restaurants is only about 2,000 dishes, two other establishments have tied in and are also enjoying the benefits of computerized menu planning.

The first move in the meal belongs to the customer. After reading the menu, the customer gives the number of his selection to a waiter. The waiter, in turn, uses a key with the particular code of the selection to operate a special cash register, which instantly prints out an itemized bill for the customer. Hopefully the food arrives as quickly as the bill.

Other benefits of a computerized system include the conservation of materials and ingredients and the elimination of daily accounting tedium. For instance, let us assume for the moment, that your appetite could be sated only by thirty-five Klyukov cakes. Your amazed-but-efficient waiter need only notify the computer center of this requirement, and in a matter of seconds the kitchen will be informed of the proper ingredients, proportions, etc., necessary for preparing the order.

It will take more than 35 Klyukov cakes to satisfy the planners of the Moscow Restaurant Trust. Engineers with taste are planning for the eventual development of a nation-wide, unified, computerized restaurant system to feed the millions who feel that they deserve a break and want to eat out. In addition to enlarging the size of the system, plans are also being made for expanding service capabilities. With the solving of certain transport logistics, some restaurants may soon find themselves in the home delivery business. As you can see, the computer specialists are trying to make this one operation where everybody wins.

Physiologist praises U.S. scientists

More than ever, Russian and American scientists are striving to learn more about each other's scientific methods and technology. This era of cooperation is exemplified by Professor Yu V. Uryvayev's recent four-month visit to the U.S. In an interview with the *Moscow News*, Professor Uryvayev, assistant to the chair of physiology at the First Medical Institute, noted some differences between American and Russian techniques. It appears that American research tends to be somewhat fragmentary, whereas Russian methods are prone to be too generalized. The professor complimented American scientists on their ability to develop and master sophisticated technical instruments in a minimum of time. He also observed that American specialists are tremendously interested in Soviet research equipment, methods and ideas. During his

stay in this country, Professor Uryvayev had the opportunity to participate in a physiological research project with Dr. C. Wilson. Both scientists conducted a short series of experiments and then published a joint report. In addition to his work with Dr. Wilson, Professor Uryvayev visited clinics and research institutes in New York, Washington, Los Angeles, and Bethesda, Maryland.

Thinking daisies

Soviet biologists conclude that plants have a sophisticated and perfect nervous system. They respond sensitively to the least changes in the environment, and send relevant reports to a nerve center which, like a human or animal brain, controls their functioning. Furthermore, it has been found that plants have memory and a language of their own.

Solar air conditioning

Soviet scientists are conducting extensive research in the applications of solar energy. Some of the results of their efforts are: a solar-powered refrigerator, a heatless hothouse warmed by rays of the sun, and a solar-driven electric razor. At the Turkmen SSR Academy of Sciences' Physics-Engineering Institute, academician V. Baum is supervising the experimental operation of a three-story building where interior temperatures are regulated by solar devices. These solar air conditioners are still just as expensive as conventional electric-powered devices. However, the new solar installations consume only one-tenth as much electricity as the conventional models. Further plans for applying the sun's energy to the needs of man include hot water heaters, stoves and hydropower plants.

New and larger transplant center

The Vishnevsky Institute in Moscow, famous for its work in the development of artificial organs and transplant methods, has expanded its operations into a brand-new 17-story building.

The new building has six operating rooms and is crammed with technical equipment: artificial hearts, videotelephones, TV monitors, etc. Patients who require highly specialized treatment are referred here from all over the country, and the highly complex services they receive are free.

The institute was formerly located near the Moskva River in an older building which now houses a medical computer center.

Today, physicians from all parts of the Soviet Union can communicate with the center by teletype and obtain computerized diagnoses from the Institute's highly-skilled physicians.

Seals swim in their sleep

People often dream that they are floating up and down in their sleep, but seals who live in the Northern Sea really do it, states a recent article in the *Moscow News*. The seals really prefer to sleep in the snow, which is their idea of a feather bed. But, while sound asleep, they might not notice the approach of a polar bear.

This explains why, for all the softness of the snow, the seals often prefer to sleep under water. Having filled his lungs with frosty air, a seal falls asleep at once and begins to sink slowly until he hits the bottom where he lies on his side and sleeps peacefully until he

gets short of air. At that moment, without awakening, he bobs up to the surface, sticks his nose out of the water, sniffs in a fresh gulp of air and goes sailing down to the bottom again.

De-salting the Vakhsh Valley

Agriculture in the formerly arid Vakhsh valley, located in the southern Tajik Republic of Soviet central Asia, is flourishing, thanks to a desalinization method recently developed by the Soviets. The soil of the Vakhsh valley has long been plagued by high concentrations of highly stable salts. Simple irrigation of the land has not made it suitable for farming, since the fresh irrigation water leaches more salts from the ground on its way to the fields. Today the soil is first irrigated, then dried, washed and drained in order to restore its fertility. Without such treatment, irrigation would lead to resalinization. Dr. Viktor Kovda of the Soviet Academy of Sciences was awarded a UNESCO prize in 1972 for his work in developing this technique.

War against smallpox

The Soviet Union has launched a highly successful fight to eradicate smallpox throughout the world, particularly in developing countries. In implementing the program adopted by the World Health Organization in 1966, the Soviets have been providing not only smallpox vaccine, but also personnel, equipment and training for local medical personnel. In addition, an effort is underway to prevent the accidental export of smallpox virus from areas where the disease is not yet controlled. Through an international effort, the World Health Organization is aiming at global eradication of smallpox by the end of 1976.

Polar bears get attention

More than 100 polar bears have chosen the island of Vrangel in the Arctic Ocean, 500 miles from Alaska, as their home. Specialists of the USSR State Hunters Organization on the island are keeping close watch on the dens and activities of their residents, and are ready to give them veterinary aid if necessary. The reason for this special attention, according to the Soviet article, is that there are only a few thousand polar bears left on our planet. To ensure propagation of these exotic animals, hunting them has been prohibited in the Soviet Union. Only in the spring when the new bear cubs are sufficiently strong, are hunters allowed to catch a few cubs for Soviet zoos. Although in the past it often was necessary to kill the parents in order to catch the cubs, now they are put to sleep temporarily by means of "sleeping bullets"—darts filled with a soporific drug shot from a special gun. After this harmless procedure the hunters take the cubs from the dens and examine the mother bears, making sure that when summer comes they leave the island healthy and unharmed. ■

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WSD3L1

The case for DDT

THE DDT MYTH. TRIUMPH OF THE AMATEURS

Rita Gray Beatty. The John Day Company. $6.95. 188 pp.

DDT, according to Rita Gray Beatty, is not the best of all possible pesticides, but it's the best we have—so why not use it until something better comes along? After you read this book, you may find yourself agreeing with her. Beatty is a plodding sort of writer, lacking sparkle and charm, but she can write short, understandable sentences. Sentence by sentence, she slogs through her data, building up a convincing case for the continued use of DDT under controlled conditions.

Her strongest point is that DDT effectively kills insect pests that eat vegetation and carry disease. Dr. Norman E. Borlaug, who won the Nobel Peace Prize for his high-yield wheats, is quoted as saying that the enormous increases in yield achieved with his wheats in Pakistan would have been impossible without DDT. But you don't have to go to Pakistan to see the effects of DDT—or no DDT. Ravaged trees in many areas of the United States last summer attested to the renewed onslaughts of the gypsy moth, a pest once controlled by DDT. Many states now ban the use of DDT.

In the United States, fortunately, diseases carried by insects are no longer a major problem, but insect-borne disease still devestates other areas. Not long ago, Dr. Guzman Garcia Martin of the World Health Organization stated that the withdrawal of DDT from the battle against malaria would halt most malaria-prevention programs throughout the world. Severe epidemics, he predicted, would follow. Experts also predict outbreaks of other feared diseases, including typhus, yellow fever and bubonic plague, if DDT use is suspended.

Why not use other, safer pesticides to fight insect pests? Beatty in one of the best-argued sections of her book, claims there *is* no pesticide presently available that is as cheap, safe and effective as DDT. Organophosphates? Most are not only expensive but less effective and more dangerous than DDT. Malathion, the safest organophosphate generally available, is not only dangerous if absorbed through the skin but, as a cholinesterase inhibitor, is capable of causing muscular spasms. Trained personnel would be needed to spray malathion for large-scale agricultural use.

Beatty is on firm ground with her arguments pushing the advantages of DDT but the ground gets mushy when she turns to its disadvantages. A chapter called "Is the Spring Silent?", in which she attempts to refute Rachel Carson's *Silent Spring*, is a real bog. Claiming that research into whether DDT causes thin eggshells or not is "confusing," the author, throughout the book simply refuses to report the results of the thin eggshell research. The reader can only conclude that she does not report it because it does not support her.

The book is subtitled "Triumph of the Amateurs," a phrase referring to the supposed victory of fuzzy-minded environmentalists over scientists in the DDT controversy but, as the book itself makes clear, most of the opposition to DDT has been mounted by

scientists—not amateurs. Beatty herself, of course, is open to charges of amateurism as regards DDT, since she is a writer, not a scientist. And for a writer critical of amateurs, she uses a surprising number of excerpts from newspaper and magazine articles written by amateurs.

Even more surprising than this dependence on amateur reporters, however, is a page-long account in one chapter quoting a Phillipine *engineer* who claims DDT is beneficial in treating leprosy. A report by an *engineer* on the potential of DDT in treating a health problem? That is amateurism.

But Beatty shines when she describes, in simple words and phrases, scientific research supporting DDT's efficacy as a pesticide and its relative harmlessness to human beings if properly applied. In putting this complex material in layman's language, she has done all us amateurs a real service. Her style, as noted, is serviceable rather than sparkling, but she occasionally relates a clever story. I liked the one about her interview with a young mother who, as she worriedly questioned the author about the effects of DDT on mother's milk, "chain-smoked seven cigarettes, drank two highballs, and took one tranquillizer."

This isn't the best of all possible books about the advantages of DDT but it's one of the few readable ones we have and it will do until a better one comes along.—*Barbara Ford*

Other new books of interest

SUPERNATURE

Lyall Watson. Anchor Press-Doubleday. $7.95. 315 pp.

Lyall Watson, a biologist, wades bravely into the sea of supernatural phenomena in this rather hefty book and comes up with an enjoyable excursion through almost every possible variation on the theme: psychokinesis, telepathy, dreams, zen, witchcraft, etc. The author has a graceful style and he keeps tight control over his unwieldy subject matter, making his book interesting and understandable.

That's the good news. The bad is that the book is not handled in a scientific manner, in spite of Dr. Watson's background. In his introduction, the author claims that he will reference all statements other than those involving his own speculations. Throughout the book, though, there are long stretches in which there is nary a reference. In other sections, there are plenty of references—most of them to popular books, popular magazine articles and parapsychology journals.

Two examples: In Watson's long discussion of astrology, the main reference, the one around which his whole argument is built, is to a popular book—a book, in other words, like his own. In his discussion of Ted Serios, the noted "sensitive" who can create photographs by thinking about them, Watson's only reference is to a book by the psychiatrist (Jule Eisenbud) who first worked with Serios. Eisenbud is hardly an objective observer.

A valid scientific book, even one aimed at the layman, simply can't be based on this sort of evidence if it is to gain acceptance among the skeptics. Watson's book, like so many others in the field, is obviously aimed at the believers. The small number of carefully-controlled scientific studies of supernatural phenomena described

by the author makes one wish he had confined his book to this data. If he had, it would have been much shorter, but much more valuable.

CRISTOFANO AND THE PLAGUE

Carlo M. Cipolla. University of California Press. $7.50. 170 pp.

The effects of bubonic plague on Prado, Italy, in 1630-1631 is the subject of this short, readable book. Cristofano is the public health officer who, harassed by lack of funds and the ignorance and fears of the city's physicians (after several die, the rest refuse to treat the sick), nevertheless achieves a victory of sorts. Only a quarter of Prado's population dies, a low death rate for those days. One revealing anecdote concerns the poor amateur surgeon who, six months after the plague was over, was still wearing the same clothes in which he had treated the sick. The city finally bought him a new suit.

MASTER BUILDERS OF THE ANIMAL WORLD

David Hancocks. Harper & Row. $8.95. 137 pp.

This book has a good idea behind it: an architect discussing the structures animals build to house themselves. Unfortunately, it doesn't quite come off. Hancocks, a zoo architect, organized his material logically—underground structures, colonial structures, underwater structures, etc.—but his writing is simply too dry to keep the reader turning pages rapidly. Nevertheless, there are some good observations, such as the author's nominations for the best animal architect—termites, tailorbirds, spiders and fan worms. The illustrations, mostly in black and white, are particularly fine.

THE VICTIM IS ALWAYS THE SAME

I. S. Cooper, M.D. Harper & Row. $6.95. 160 pp.

In this immensely compassionate little book, a neurologist and surgeon describes two patients afflicted with dystonia, a rare genetic nervous disease that twists the victim's limbs into pretzel-like shapes. After an operation in which a tiny part of their brain is destroyed, the patients, both young girls, recover to lead almost normal lives. The most memorable part of the book is not the surgery but the description of the long years in which both patients and their families underwent useless and expensive psychiatric treatment because the children had been mistakenly diagnosed as emotionally disturbed.

GIANTS IN THE SKY

Douglas H. Robinson. University of Washington Press. $15.00. 325 pp.

This thorough, handsomely-produced history of the rigid airship covers 40 years and 161 ships, including the ill-fated German *Hindenburg*. You may be surprised to learn that although 36 passengers died when the *Hindenburg* exploded into flames in 1937, 62 escaped—making the disaster a rather small one by modern standards. It would not have burned at all, claims the author, if safe helium gas had been used instead of hydrogen, but the United States, which monopolized helium, refused to sell it to Germany. Although details like this are fascinating, the author's style is almost as ponderous as a rigid airship and restricts the book to those with a serious interest in the subject.

VISCERAL LEARNING

Gerald Jones. The Viking Press. $6.95. 148 pp.

This short book explores the work of psychologist Neal Miller of Rockefeller University, who claims we can train ourselves to control our supposedly involuntary nervous system by means of bio-feedback devices that reward us for doing so. Miller and others have succeeded in teaching humans to lower their blood pressure, raise their temperature and blush on cue, among other feats. These results contradict the tenets of behaviorism, the dominant force in American psychology, and the book describes the opposing views of behaviorist B. F. Skinner. The author, a member of the *New Yorker* staff, makes this rather difficult material easy to read and grasp.

THE ANIMAL IN MAN

Lorus and Margery Milne. McGraw-Hill Book Co. $7.95. 228 pp.

The Milnes tackle a big subject in this one: the similarities and differences between the behavior of humans and other animals. The book seems to cover almost every noted animal behavior research study carried out in the past quarter-century on creatures ranging from butterflies to gorillas. Due to the vastness and diversity of this material, the book, while extremely well-written, ends up being something of a grab-bag of interesting facts. The strong theme that would have tied everything together is lacking. Also, the authors' style here is somewhat impersonal, giving the book a lofty, textbook-like tone.

YOUR BRAIN AND NERVES

J. Lawrence Pool, M.D. Charles Scribner's Sons. $7.95. 183 pp.

Dr. Pool, a neurosurgeon who was chairman of neurological surgery at a noted New York hospital for many years, describes the ailments that affect the brain and nerves and the surgery that is performed to relieve them. Topics covered include brain tumors, brain injuries, spinal disorders like multiple sclerosis that affect the muscles, epilepsy, strokes and even aching backs caused by spinal disc problems. Putting complex subject matter like this in laymen's language isn't easy but Dr. Pool makes it look that way. His language is so direct and simple that anyone who reads can understand what he says. Most of the case histories come from his own files.

THE AMATEUR ARCHAEOLOGIST'S HANDBOOK

Maurice Robbins with Mary B. Irving. Thomas Y. Crowell Co. $7.95. 222 pp.

How do you tell a female skeleton from a male one? Look at the pelvic bones—the female pelvis is wider and shorter and the pelvic cavity round in cross section The male cavity is triangular. This is just a sample of the helpful data in the new edition of this book, which tells you, in simple terms, everything you need to know about finding and excavating an archaeological site. The emphasis is on prehistorical Indian remains in the United States but there is a chapter on historical sites. An interesting introductory chapter describes who lived where in early North America. Good black and white drawings, diagrams and photographs are included.

THE NEW OUTLINE OF SCIENCE

David Dietz. Dodd, Mead & Co., 1972. $17.50

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(BOOKS—continued on p. 96)

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(BOOKS—con't from p. 91)

ing five thousand years, can one fully come to appreciate the accomplishments of modern technology. David Dietz, science editor for Scripps-Howard newspapers, in this book attempts to present a unified and organized view of modern science. Breaking the book down into four major categories, he begins with "The Universe," an account of what accomplishments have been made in modern astronomy and space exploration. "The Earth" deals with our planet's natural resources, origins and evolution. "The Atom" studies the organization of matter and nature of energy. "Life" carries the story of microscopic forms of life to the climax in man. The book emerges as a valuable ready-reference text and provides an interesting overview.

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IN THIS ISSUE

In this month's book excerpt, a marine archaeologist tells how he set out to recover artifacts from the sunken city of Port Royal, Jamaica, in order to reconstruct how life was lived in the old pirate city. But he found more than that—sharks and other dangers along with some [illegible] booty.

Storm King Mountain on the Hudson River has sparked a battle between ecologists and the country's largest power company. See page 76.

Acupuncture has grown so popular that even do-it-yourself models like the one at right are now available. But beware. Acupuncture is no panacea and can even kill. See page 10.